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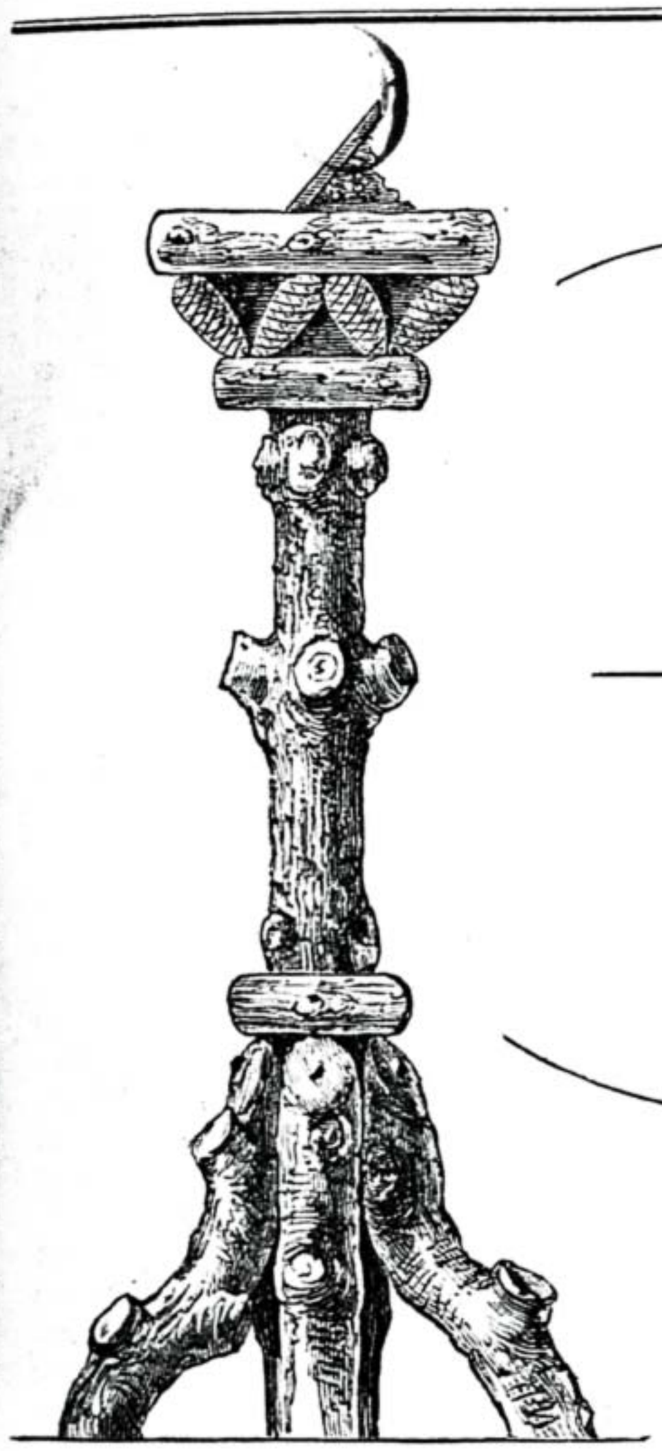

Fig. 5.—Design for Rustic Pedestal for Horizontal Sun-Dial.

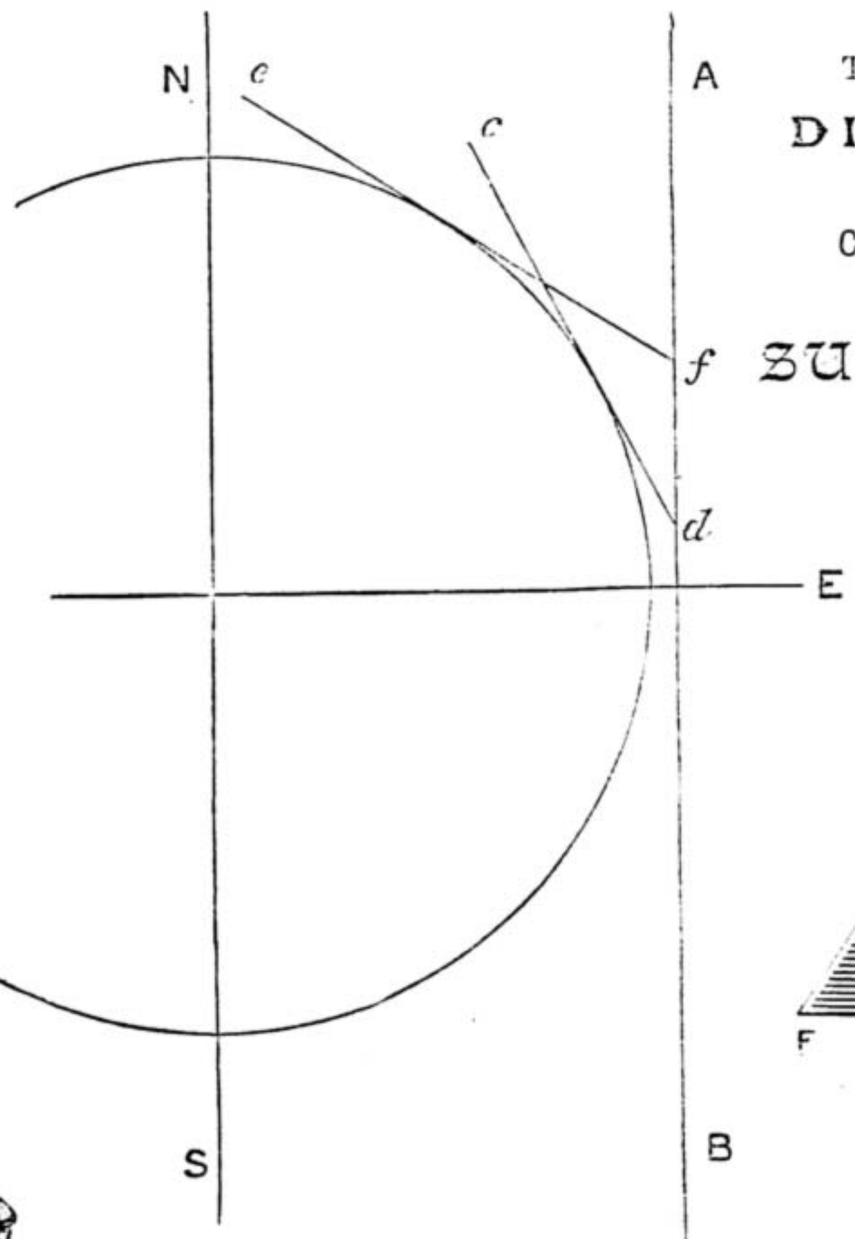

Fig. 1.—Principle of the Horizontal Sun-Dial.

THE ART OF DIALLING AND CONSTRUCTION OF SUN-DIALS.

HOW TO SET OUT AND MAKE HORIZONTAL SUN-DIALS.

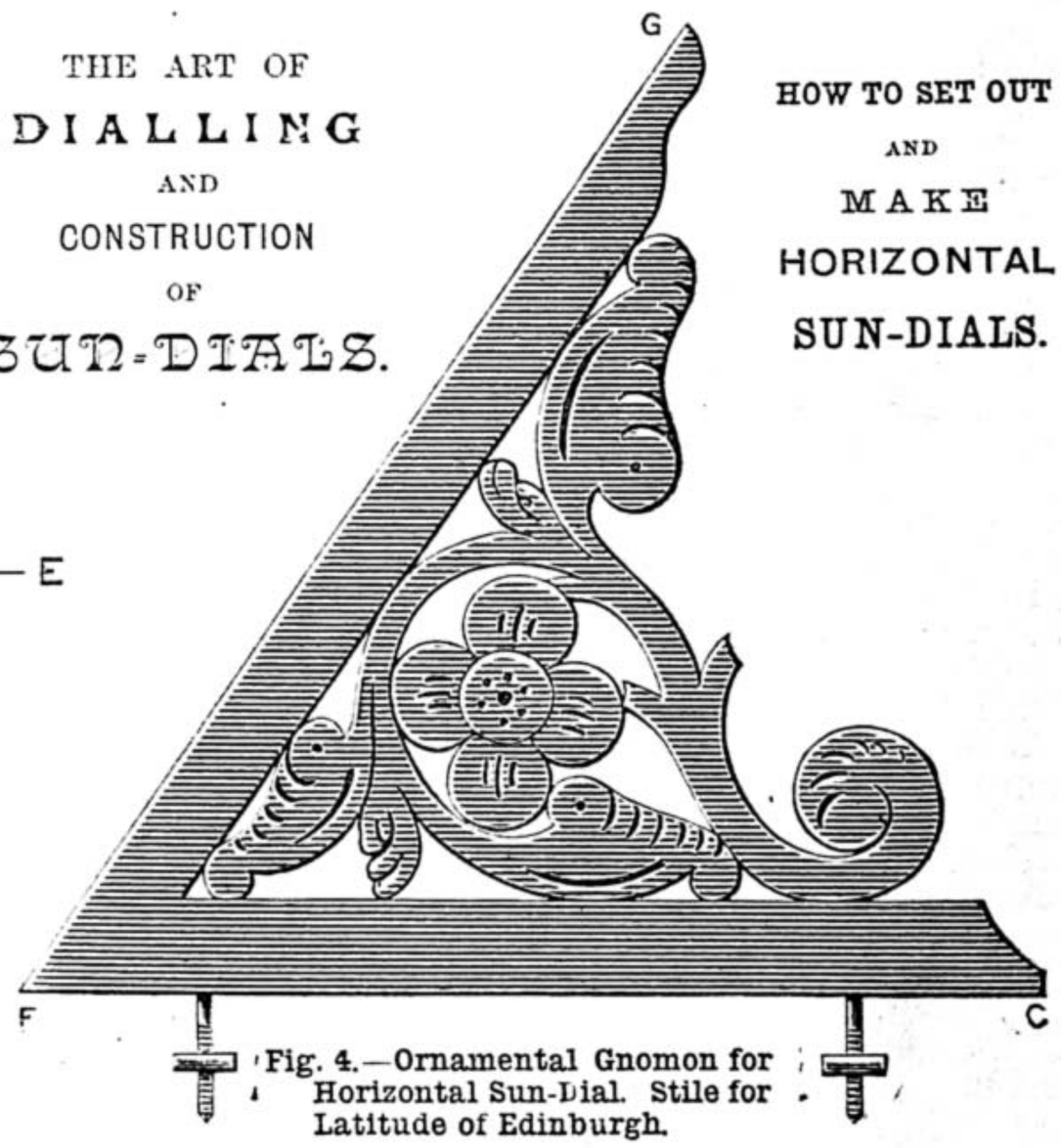

Fig. 4.—Ornamental Gnomon for Horizontal Sun-Dial. Stile for Latitude of Edinburgh.

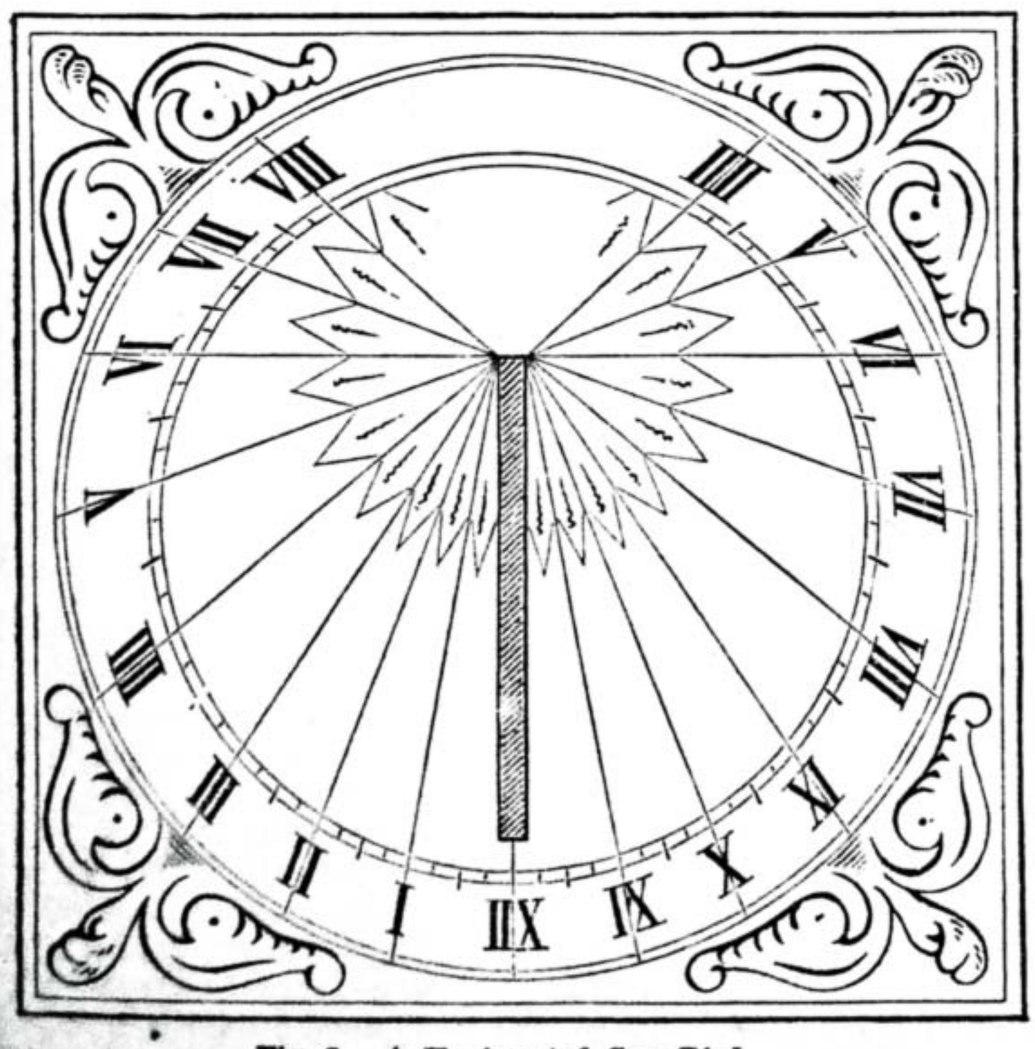

Fig. 3.—A Horizontal Sun-Dial.

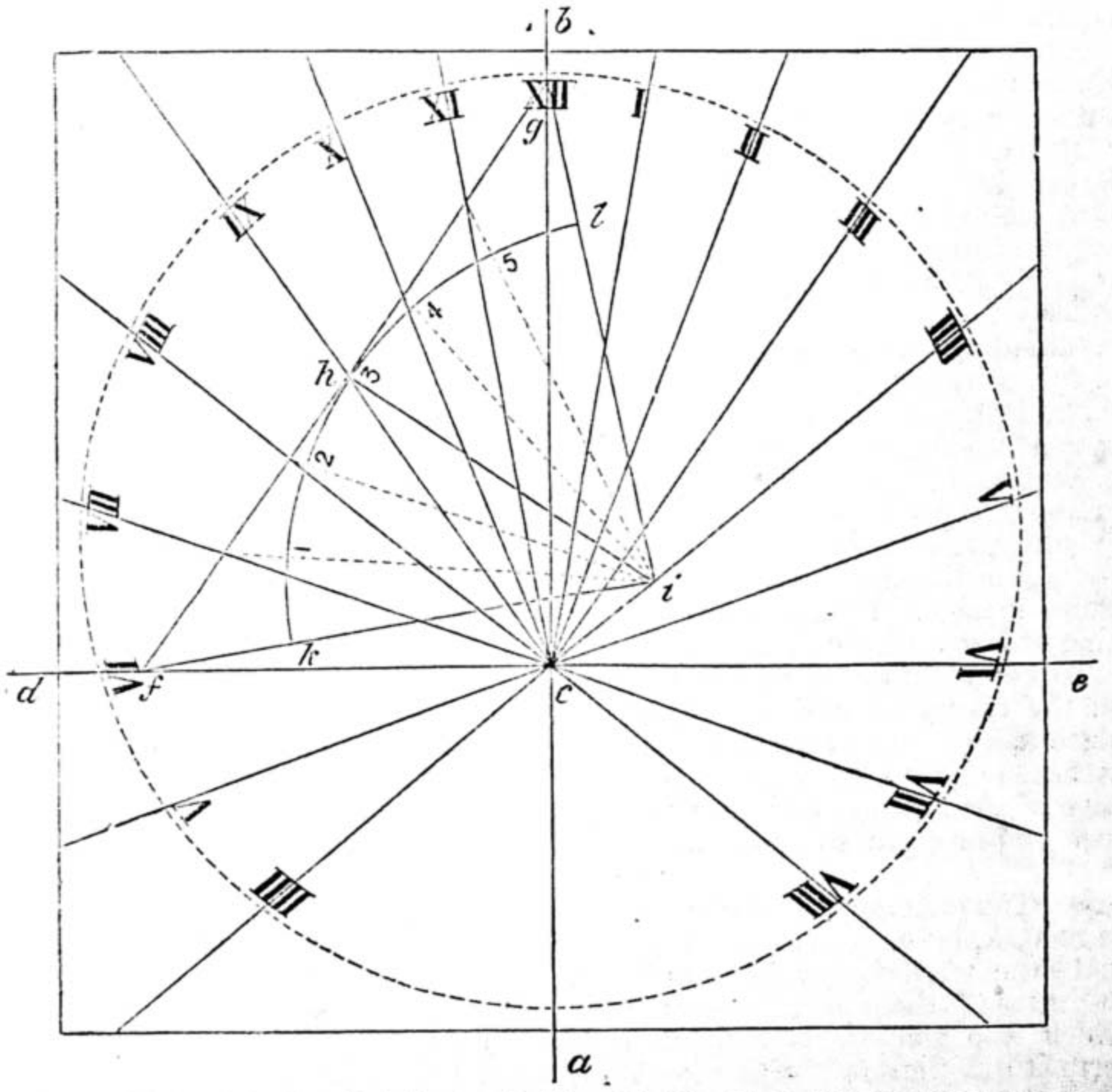

Fig. 2.—Mode of Setting Out Horizontal Sun-Dial for the Latitude of Edinburgh.

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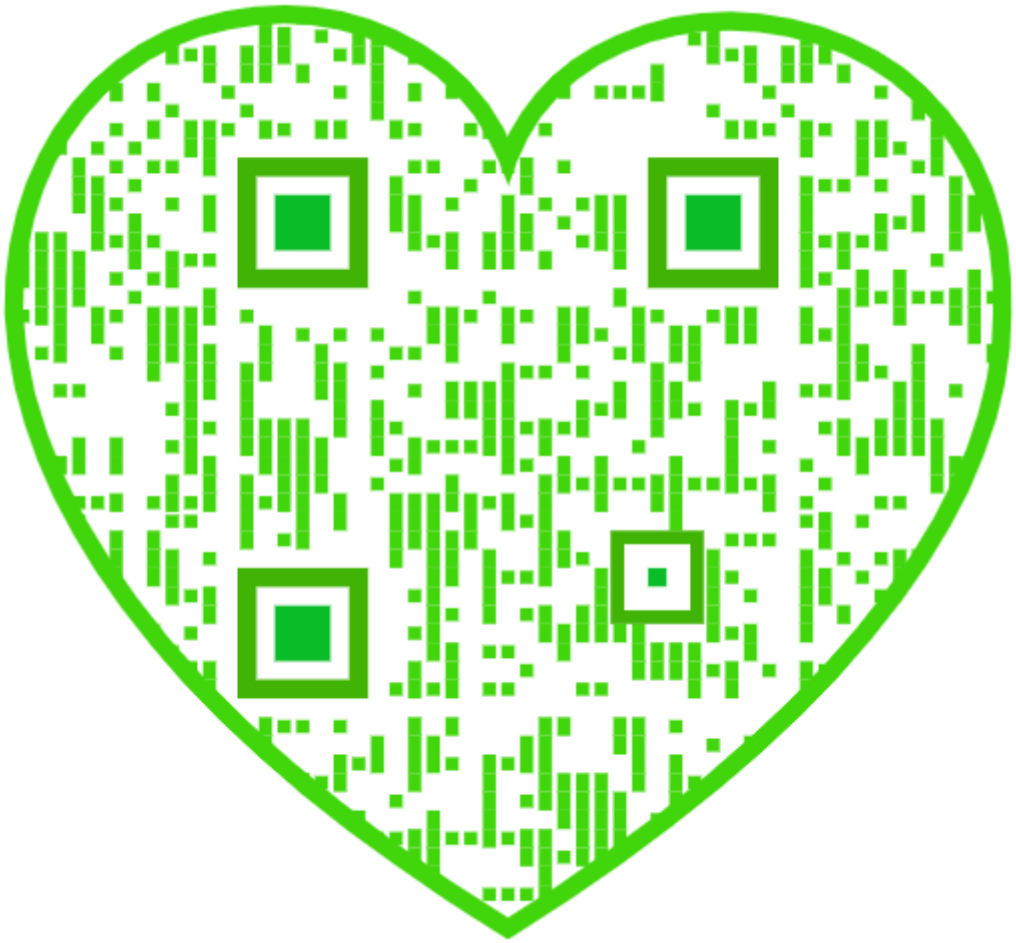

THE ART OF DIALLING AND CONSTRUCTION OF SUN-DIALS.

BY ARTHUR YORKE.

How to Set Out and Make Horizontal Sun-Dials.

FACTS ABOUT SUN-DIALS—DIFFERENT KINDS OF DIALS—PRINCIPLES OF DIALLING—LAYING OUT A HORIZONTAL DIAL—THE GNOMON—DIFFERENCE OF TIME BETWEEN SUN AND CLOCK—MATERIALS FOR MAKING DIALS—PEDESTALS—A RUSTIC PEDESTAL.

SUN-DIALS, for the construction of which I am going to give practical directions, date as timekeepers from a very respectable antiquity. According to Pliny, they were invented by Anaximander 550 years B.C. From our received Biblical chronology, however, they must have been known in the East considerably earlier. Some 250 years after the above date they were introduced at Rome, where at a later period—under the emperors—they became so much the fashion that no public building was without one.

Possibly from their having been associated with heathen temples, the early Christians seemed to have looked on them with disfavour, for they are said not to have been used on churches till the seventh century; through the Middle Ages, however, and till the general adoption of clocks, almost every church had its sun-dial.

Dials can be, and have been, constructed to suit almost every position in which it is possible for the rays of the sun to fall upon them; even moon-dials have not been unknown; but the only dials reasonably simple in their construction, or of much practical use, are the horizontal and the vertical. Vertical dials are those usually affixed to the walls of buildings, and of these, that made to face the direct south is the most simple, the most symmetrical in appearance, and the most valuable as a time-teller. The south dial points the hours from 6 to 6; the east dial points the morning hours only; the west dial those of the afternoon; whilst the north dial indicates merely three hours of the summer days before the south dial begins and after it ceases to act. Declining and reclining dials are complex in their construction and but little used. I shall, therefore, omit all further mention of them.

But of all the dials, the horizontal must be considered the most complete, since it continues to tell the hours (always considering the skies to be clear) as long as the sun is fairly above the horizon. Dials of this kind we generally see of small size and mounted on pedestals; yet the largest dial in the world—proudly styled by its maker "The Prince of Dials"—is one of this kind. It is at Delhi, India, and has a gnomon or indicator 118 ft. long. It is of solid masonry, the stile—that edge of the gnomon by which the shadow is cast—and the circle on which the hours are marked being of white marble. It was made at the beginning of last century by the Rajah Jeysing.

To enter into any profound dissertation on the theory of dialling would be out of place in a practical article like the present. It needs only to be said that in all dials the edge of the gnomon by which the shadow is cast is presumed to represent the axis of the earth, and must always be parallel to that axis. The gnomon, it is perhaps unnecessary to remark, is the projecting feature of the dial—the word simply signifies "that which indicates;" the upper edge of it, that by which the shadow is cast, is technically termed the "stile;" whilst its lower edge, that which lies upon the face of the dial, is termed the "sub-stile." In a horizontal dial the face is presumed to represent the plane of the natural horizon, and must be parallel with that plane; in other words, it must be a true level. But the face of a vertical dial must always be at right angles to the plane of the horizon; in other words, it must be upright.

As the direction of the earth's axis will always remain the same, whilst the direction of the plane of the horizon will constantly vary as we approach to or recede from the Equator, the angle formed by the two must needs be a varying one, and it will be obvious that dials made for places in different latitudes cannot have similar gnomons. As we approach the Equator, the angle at which the stile of a horizontal dial rises will become less; as we recede from it that angle will increase. This may be most readily demonstrated by a diagram. Fig. 1 represents a portion of the earth; E is the Equator, N S is the earth's axis, A B is a line drawn parallel to the axis, *c d* represents the plane of the horizon at a point comparatively near to the Equator, *e f* will be the plane of the horizon at a point more remote from the Equator. The angles formed at *d* and *f* will be the angles for the gnomons of horizontal dials for those two points respectively.

It is with horizontal dials only that we have at present to deal. These have been mentioned as the most complete, and they are so for this reason—they serve to tell the time throughout the whole day, which, at its longest, may in this country be said to extend from 4 a.m. to 8 p.m., whereas even a south vertical dial will tell the time from 6 to 6 only. The method of setting out a horizontal dial is shown in Fig. 2. Since we shall not require to construct our dial on exactly the same scale as that of Rajah Jeysing, we shall do well to take a piece of paper on which we can make our drawing to the size of our actual work; we shall then have merely to trace it off on our dial-plate.

We first draw the line, *a b* (Fig. 2), through the centre of the paper. This will represent the meridian, and will be the line on which the sun will appear at 12 o'clock. At slightly more than one-third of the distance from *a* to *b*, we then draw a second line, *d e*, bisecting the first at right angles, as at *c*. As we call *a b* our 12 o'clock line, we may call this our 6 o'clock line.

This done, we have to ascertain the latitude of the place for which we intend our sun-dial. The orthodox way to do this is by working out a simple problem on the terrestial globe; but it is not every one who has globes or who knows how to use them, and it will be sufficient for all practical purposes if we look at our position, or that of any more important place of which the latitude is virtually the same, in a gazetteer or in the index to an atlas.

We now at any suitable point on *d e*, as at *f*, set off a line, *f g*, which will form with *f e* an angle equal to the latitude. Let us say that our dial is for the latitude of Edinburgh, which we have found to be 55° 57′ 3″. For our purpose, we may call it 56 degrees; we, therefore, make our angle one of 56 degrees. Were our dial for London, of which the latitude is 51° 30′ 8″, we should make our angle equal to 51½ degrees. Possibly, the diallist may have a rule marked with a "scale of hours;" if so, he will merely have to set off his points from it on the line, *f g*, and draw his hour lines through them from *c* to the edge of the paper; he will then have his morning hour lines, that is, the lines along which the shadows will fall at the hours between 6 a.m. and noon. But let us presume that he will not have this convenience, and that he will have to proceed in the manner indicated in the diagram. From the centre of *f g*, a perpendicular, *h i*, equal to half its length, is let fall, and lines are drawn joining *f i* and *g i*; then with *i* as a centre, and *i h* as radius, a quadrant is described from *k* to *l*. This has to be divided into six equal parts as at 1, 2, 3, 4, 5. From *i* lines are drawn through these points till they cut the line, *f g*, and through the points of intersection so formed other lines are drawn from *c* to the edge of the paper, as at *c*VII., *c*VIII., *c*IX., *c*X., *c*XI. These are the morning hour lines required. To these the afternoon hour lines will exactly correspond, and may be measured off from them, or traced off by folding the paper down the meridian line: IV. and V. in the morning, and VII. and VIII. in the evening, have as their hour lines mere continuations of the afternoon and morning lines opposite to to them, as may be seen in the diagram.

Half and quarter-hour lines are ascertained by sub-divisions on *k l*, by merely continuing the process which gives the hour lines.

It is usual on a horizontal dial for appearance and ease of reference to place the numerals which denote the hours in a circle. This has been done in Fig. 2; but it should be remembered that this is no necessary part of the dial. As a matter of theory, the gnomon is regarded as a mere line without thickness, but in practice, it must be more or less thick according to material and size; and to make the circle look true, it will be necessary before drawing it to cut the paper plan in two down the meridian line, and paste the two parts together again, leaving a space between them as wide as the thickness of the gnomon. In the illustration, Fig. 3, it will be seen that this has been done.

The gnomon for the dial before us, as regards its essential feature—that is, the angle at which its stile inclines to the face of the dial—will be a repetition of the triangle, *g f c*, Fig. 2. If we could take that triangle and place it upright on the plan with the angle, *f*, on point *c*, and with the line, *f c*, extending along the meridian in the direction of *b*, it would, in theory, be all that we should require to complete our work. In Fig. 4, a gnomon for the latitude required (56 degrees) has been drawn separately, and for convenience and reference marked with the same letters, G, F, C. It is not drawn to the same or to any scale, being required large that the ornamental design may be properly shown, but a gnomon ought to be of such dimensions as fairly to throw its shadow to the circle of numerals. It will be observed in Fig. 3 that the stile is left perfectly straight. The stile is the business part: this edge it is which marks the time by casting its shadow, and whilst it matters little into what decorative forms we cut the under part of the gnomon, this must always remain a right line.

Mention has been made above of the 12 o'clock line or meridian, as the line at which the sun appears daily at 12 o'clock; but this must be taken as being only approximately correct. If the apparent path of the sun were in the Equator instead of in the Ecliptic, he would (though there are some other trifling disturbing influences) come pretty regularly to this line each day at 12, and the dial would be as simple a time-teller as the clock, and, in most cases,

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far more accurate, but since he does move in the Ecliptic, and since the plane of the Ecliptic is not parallel to that of the Equator, there are but four days in the year when he is actually in the meridian at 12 o'clock, these being March 20th, June 21st, September 23rd, and December 21st. On the 1st of November, the dial will point to noon a quarter of an hour too soon. The difference between sun and clock is calculated and given in most almanacks, and should be ascertained before correcting a clock by the dial on any except the days mentioned. Moreover, if we propose to fix our dial by the sun, we shall do well to choose one of these four days for so doing.

Since a horizontal dial will in almost every case be fixed on a pedestal where its face will scarcely be seen except by those who go to consult it, that face is scarcely a subject for elaborate ornamentation. The gnomon only will be conspicuous, and this it is and the pedestal which should be made decorative. Brass or copper is, as a rule, the best material for the face of a horizontal dial. If, when upon a stone pedestal, the face is of the same, and the lines, etc., are incised, water will be apt to stand in them to the injury of the stone, which will especially suffer in frosty weather; whilst if the lines are simply painted on the freestone they will not be permanent. Slate is better for the purpose than freestone, since on this the lines will need to be little more than scratched, so that they will not hold water; but even this is less satisfactory than metal. On a piece of stout sheet copper a non-professional worker can readily incise his lines with a graver, and if ornament is desired, much may be done in that direction with punches. The face of a horizontal dial is drawn in Fig. 3.

On a slate dial a gnomon of the same, cemented into a groove cut for the purpose, might be made to serve; but exposed as is this feature of the horizontal dial to injury, this material can scarcely be recommended. It would, indeed, have the advantage of being perfectly rigid, but it would run much danger of being broken sooner or later. A metal gnomon is far superior, and one that is cast is to be preferred to one cut from sheet metal. Sheet metal is too apt to bend, and if true time is to be told, the stile must remain true. Any one who can handle tools can cut a pattern of his gnomon in thin wood or in lead and have it cast in brass, which will cost but a few pence, since he can file and finish it up himself. Fig. 4 is an ornamental gnomon intended for casting. The brass gnomon will probably be fixed to the dial with screws and nuts, as shown in Fig. 4, otherwise it should be hard-soldered.

The best pedestal for a horizontal dial is undoubtedly a stone one, set on a good foundation of masonry. This will least be in danger of getting out of the perpendicular, and thus rendering the dial useless as a time-teller. But comparatively few among those who may wish to play the diallist, and who may desire to do all the work in connection with their own hands, will be able to hew or set up a stone pedestal. I, therefore, give a design for one in rustic woodwork (Fig. 5) which will be within the capacity of a far wider circle of workers. As the design is rendered so clearly that its construction cannot be mistaken, those who wish to make one will find little difficulty in carrying it out. The upright will best be of larch, though any other straight piece of rough wood will do, and it should be let into the ground a couple of feet and well rammed with stones so that it may be in little danger of displacement. The four rough struts at its base, which should also be let some distance into the ground, will do much towards keeping it firm. The top should be a slab of oak by preference, not less than 3 in. thick, that it may stand solidly, and be in no danger of warping. The hollow moulding beneath the top is ornamented with fir cones.

A dial needs to be fixed with exactness, and that its face lies level, may be proved by the spirit level or the mason's plummet. The gnomon must be exactly upright, and in a line due north and south. It can be fixed by a compass, or otherwise by the sun on one of those days upon which he comes punctually to the meridian.

The writer hopes to give shortly a second paper dealing with vertical dials.

STRETCHING VELLUM FOR ILLUMINATING.

BY LANCELOT L. HASLOPE.

SOME years ago I commenced to illuminate a book, the pages of which were of vellum.

Mode of Stretching Vellum for Illuminating—A A, Drawing Boards; B B B B, Brass Plates; C, Sheet of Vellum stretched.

I had not got far with the first sheet before I found, to my great disgust, that when a body of colour was laid on, as, for instance, in a highly ornamented capital letter, when the vellum was dried it "cockled," so that the effect was entirely spoiled. I could get no assistance in my difficulties from artists' colourmen, nor from the authorities at the British Museum. I was, therefore, thrown entirely on my own resources. I had purchased my vellum cut into sheets 9½ in. by 7½ in., and the problem to be solved was how to stretch these sheets so as to get a perfectly smooth surface to work on that would remain smooth after the painting was finished. The difficulty was intensified by the fact that both sides of the vellum had to be illuminated, and consequently each sheet had to be stretched twice. I will not weary my readers by recounting all the experiments I made, and which all resulted in failure, until I fortunately hit upon the following simple plan, which fully answered all my requirements.

I procured a drawing-board 14¾ in. by 15½ in., and four pieces of rolled brass, quite flat, two of them 12 in. by 1¾ in., and the other two 7 in. by 1¾ in.; the thickness of the brass was about ⅛ in. Four slots were cut about 2½ in. apart in each of the long pieces, and three slots in the shorter ones; the length of the slots was 1 in. Brass screws, with a washer under the head of each, went down through the slots, and screwed into sockets let into the back of the drawing-board. To use this board, the pieces of brass plates are drawn back as far as they will go, and the sheet of vellum laid in the middle of them. As vellum absorbs moisture very readily, it is only necessary to take the board into a damp atmosphere such as a cellar for about ten minutes or a quarter of an hour, and it will have expanded sufficiently. The pieces of brass should now be pushed inwards until they rest for about ⅛ in. on the sides of the vellum, and firmly screwed down. If the board be now removed into a warm room, the vellum will become perfectly flat, and present as good a surface as any artist could possibly desire. When one side is finished, the screws may be loosened, and the vellum stretched with the other side upwards. The advantage of this method is that the face of the vellum is entirely uninjured. As an immense amount of work was put on these sheets, it was worth my while to go to some trouble to make my drawing-board quite complete, but when one sheet of a size only has to be illuminated, a much simpler apparatus might be adopted. For instance, the pieces of brass might be represented by strips of fret-wood, and the slots might be omitted, the pieces of wood being merely screwed down into a board with a common wood screw. In this case they should be first of all fastened down into their places, and then removed to allow of the vellum being put under them; they must be screwed down finally while still in the damp atmosphere. If no other means of damping the vellum are available, it might be held over hot water for a short time, though this plan would require a good deal of caution, for fear of injuring the vellum. A very slight amount of damping is sufficient to render the sheets quite flat when dried.

HOW TO MEND A BROKEN BAND SAW.

BY ONE WHO HAS DONE IT.

I NOTICE that a reader of WORK has asked for instructions how to mend broken band saws, and also the cause of their breaking. I am afraid I cannot satisfy him as to the cause, unless it is that the tension is too tight, but they are liable to break even when the greatest care is taken to prevent it. I have had them run for days together without breaking, and I have also had them break before cutting six inches; but fortunately they are very easily brazed together if one only knows the way. I formerly sent them to London to be brazed, but the inconvenience of having to stand still a day or two every time they were sent led me to try my hand at them myself, and after trying several different ways, I found that the one I am about to describe was the easiest and simplest, as well as being the cheapest. The apparatus required can be made by any one, and after it has been made you can mend a saw in half an hour, and be at work with it again.

The first thing required is a trestle, as in Fig. 2, made from a piece of 7 in. by 3 in. batten about 3 feet long, edged up, as shown, and mounted on four legs about 3 feet high. On the top edge, at A, cut a notch about 6 inches long and 3 inches

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deep. Make four wood buttons, as at B. These are best made of hard wood. They are (as will be seen by sketch) to hold the saw in position, as at C C (Fig. 2).

You will next require two pairs of heavy tongs, same as those used by blacksmiths, but with very thick heavy jaws, so as to hold the heat. They must also be made true, so as to grasp the saw firmly the whole width, and not at one edge only.

All the rest of the necessary appliances are a good flat file (the same as circular saws are sharpened with are best), some spelter, which can be obtained at any ironmonger's—or brass filings will do equally as

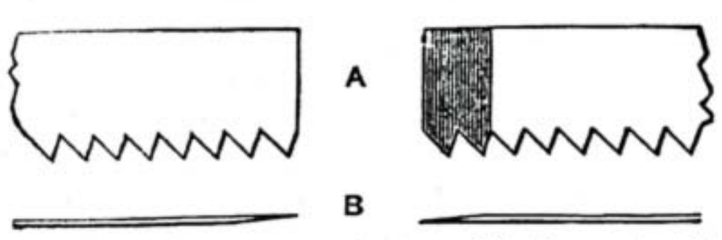

Fig. 1.—Ends of Band Saw fitted ready for Brazing—A, Plan; B, Section.

well—and some borax, powdered; but in buying the latter, it is best to get the stone borax and powder it yourself, as you know then that it is pure. Now, having got all the apparatus together, we will proceed to work.

In the first place, take the broken saw, and laying it on the floor between the legs of the trestle, bring one end up along the top, and passing it under one of the buttons, screw down tight, with the end of the saw level with the end of the top of trestle. Then file a bevel the length of two teeth off to a feather edge, as shown in Fig. 1. When that is done, reverse the saw, and do the same with the other end, but take care and file the bevel the other side of saw, so that when the two ends are brought together the saw is no thicker there than anywhere else. This requires some practice with the file, as the bevel should be perfectly flat and come to a sharp edge, but not thin enough to turn it. However, it is easy enough to any one who has been in the habit of using a file. When the bevels are perfect, place the saw on the floor again between the trestle legs, and bring the two ends over top of

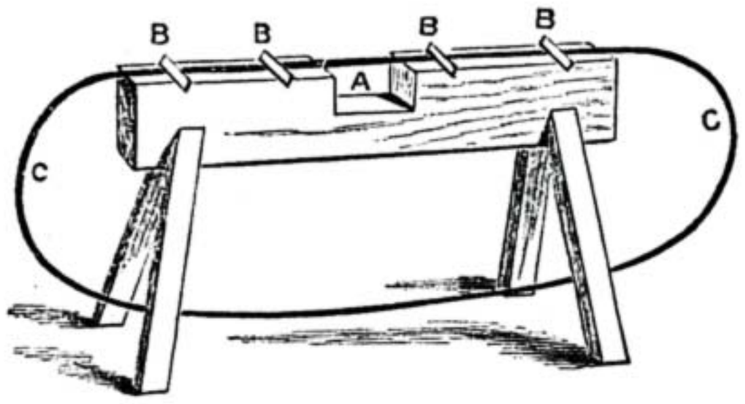

Fig. 2.—Trestle for Brazing Band Saw—A, Notch in Top for Jaws of Tongs; B, Buttons; C, Saw in Position for Brazing.

trestle under the buttons, so that the laps meet in the centre of the notch A. Then screw all the buttons down tight, keeping the back of saw parallel with side of trestle, and keeping the laps in proper position, so as the teeth of saw intersect. Then wet some of the borax so as to make a stiff paste, and put some underneath and on top of the joint, also a little in the joint. Then take a small quantity of spelter or brass filings, as the case may be, and put as much as will lay in the joint. Also sprinkle a little on top with the borax. All this being done, place one pair of tongs in the fire—a forge is best, but an ordinary fire will do—and heat them to a very red heat; also heat the others to a dull red. Then taking the hottest tongs, slip them carefully over joint and clasp firmly, and when the spelter is melted—which will be in a minute or two—carefully slip off the tongs, and at the same time slip on the cooler ones, and hold tight for about a minute, when the joint will be found to be as strong as any other part of the saw, and, if properly done, only a small thread of brass will be seen on each side.

The only way to find out the proper quantity of spelter is by experience. The least quantity that will do is the best, as it only has to be filed off, but there had better be too much than too little, as if too little, a good strong joint is impossible.

All those who try the above way of mending band saws will be convinced that it is a much better way than doing them with a forge, which speedily draws the temper of the saw and ruins it. The only thing that needs caution is, be sure and get the saw as thin at the splicing as at other places, and also to keep it straight at the back. If these things are not attended to, the saw will never work properly, and will most likely break again very shortly.

I think I have explained everything sufficiently, so that any user of band saws may mend his own if he tries to do so, and I am sure, as in my case, the saving will be considerable, not only in money, but in the saws being better done. At the same time, if there is anything which is not made quite clear, I shall be pleased to rectify it in the "Shop" columns, if any one should express a wish to that effect.

Perhaps some one will say he does not see why it is necessary to have two pairs of tongs, as the first one melts the spelter, which is all that is required; but wait a bit, for I am able to answer your question, as I have said the same myself. The reason is as follows:—If one pair only were used, they would have to be held on the joint till the spelter was solid again, which would be much too long to be comfortable. Well then, say you, what do the second pair want to be hot at all for? Why not use them cold? I have also tried this, and found that using the cold tongs made the saw and spelter so hard that it was a difficult matter to file it off, so I found the better way was, as I have said, to use one pair to melt the spelter, and one pair of hot ones, though cooler than the others, to cool the joint gradually; and as we are told that experience is the best teacher, I can fairly claim to know, having brazed hundreds of joints, both large and small, and my way has been exactly as I have, in the best way I can, described above. Wishing the readers of Work, and Work itself, every success, I will now conclude what I hope will be an acceptable paper to many.

BIRD-CAGES: HOW TO MAKE THEM.

BY FRANK HINDS.

Having read in "Shop" (Vol. I., p. 509) that some of its readers would like to make a bird-cage, I take it for granted that it is a breeding-cage for canaries that is wanted. I venture to submit drawings of some bird-cages, one of which I intend to make for myself.

I have made several bird-cages for myself. The first consideration is, What kind of dwelling will best conduce to the birds' health and happiness? If birds are kept in a state of confinement, which is not natural to them, it should ever be borne in mind that they are so for the pleasure or profit of those who keep them, and with whom it ought to be a matter of duty to see that they are properly cared for, and rendered as comfortable as circumstances will admit.

In making a bird-cage, four things are necessary—that is, the comfort of the birds, the prevention of vermin that infest cages, the prevention of the birds littering about, and that it should be easy to clean out and feed. Of wooden cages, those are decidedly the best which are made of mahogany, as they are less likely to harbour insects than any other. One of the cages herein described is to be made of mahogany, one to be made of mahogany and stout wire, and the other to be made of all metal, so that those who like to work in metal may be obliged as well as the wood-workers (Vol. I., p. 445). Taking the mahogany one first, I shall not attempt to describe all the getting of the wood, planing, squaring, gauging, and joining; all this has been described before in Work (Vol. I., pp. 250, 307, 358).

You will see by the illustrations that the cages can be divided into two by a division. This division must be made of wood, so that when it is to be used for two breeding-cages the birds will not be able to see each other, as they are sure to fight, and the hen will not go to nest so soon. You will see that the woodwork is very deep at the bottom, for birds, however tame and familiar, like to have snug corners or sheltered places to which they can occasionally retire and shun observation. This should be at least six inches deep. There is no seed or water outside, for I have found it much better to put the seed and water into the cage. This is better for the birds, for they can get at it all together, and it prevents them littering it about outside.

Now, having got your frame fitted together (not fixed), take all to pieces, and gauge each piece where the wire is to go through.

I will now describe how to make the marker to mark where the holes are to be bored. Get a piece of wood, say, one inch square, and as long as the shortest piece in the cage; gauge it along the centre one side, and mark off half-inches all the way along; and drive small nails in each mark, leaving one-eighth of an inch above; sharpen these to a point (Fig. 5 will show you what I mean). With this marker you can mark all the pieces of mahogany that are to be bored for the wire to go through. I decidedly should have tinned wire, and not brass. You can get any quantity at W. Hughes', 37, Drury Lane, W.C., if you send a small piece of wire the gauge you want, and something like the quantity you may require. It is sold by the pound. The wire must be quite soft when you buy it; it gets hard by keeping. I should not get the wire until I had put the cage together. The way I have straightened the wire is by drawing it between four or five French nails or screws; put one each side of a straight line (Fig. 6 will show you). Having a piece of wood with these nails driven in fixed to the bench, draw the wire through to a mark the length of the wire required, and with a little rub with the hand you will find it quite straight.

To bore the holes, you can make your own drill by getting a small piece of steel wire the same gauge as the tinned; flatten the end, and just file it the same shape as a drill for iron; fix it in the drill-stock, and try it to see if the wire will go through easily. Have it just the length to go through the pieces that the wire is to go right through, and have another drill a

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little more than three-quarters of the thickness of the piece of wood where the wire is not to go right through, as every hole must be filled to prevent the insects from getting in.

Having bored all the holes, leaving a space where the two doors are going to swing, the next thing is to put your cage together and fix it. But do not put the bottom on yet; leave that till last. I should nail one or two battens on the bottom to keep it square. Well, having made all good joints, and strong, sand-paper all over, and French polish it (Vol. I., p. 506).

Having got thus far, we will start wiring. Make a template out of 1-inch wood the shape you are going to make

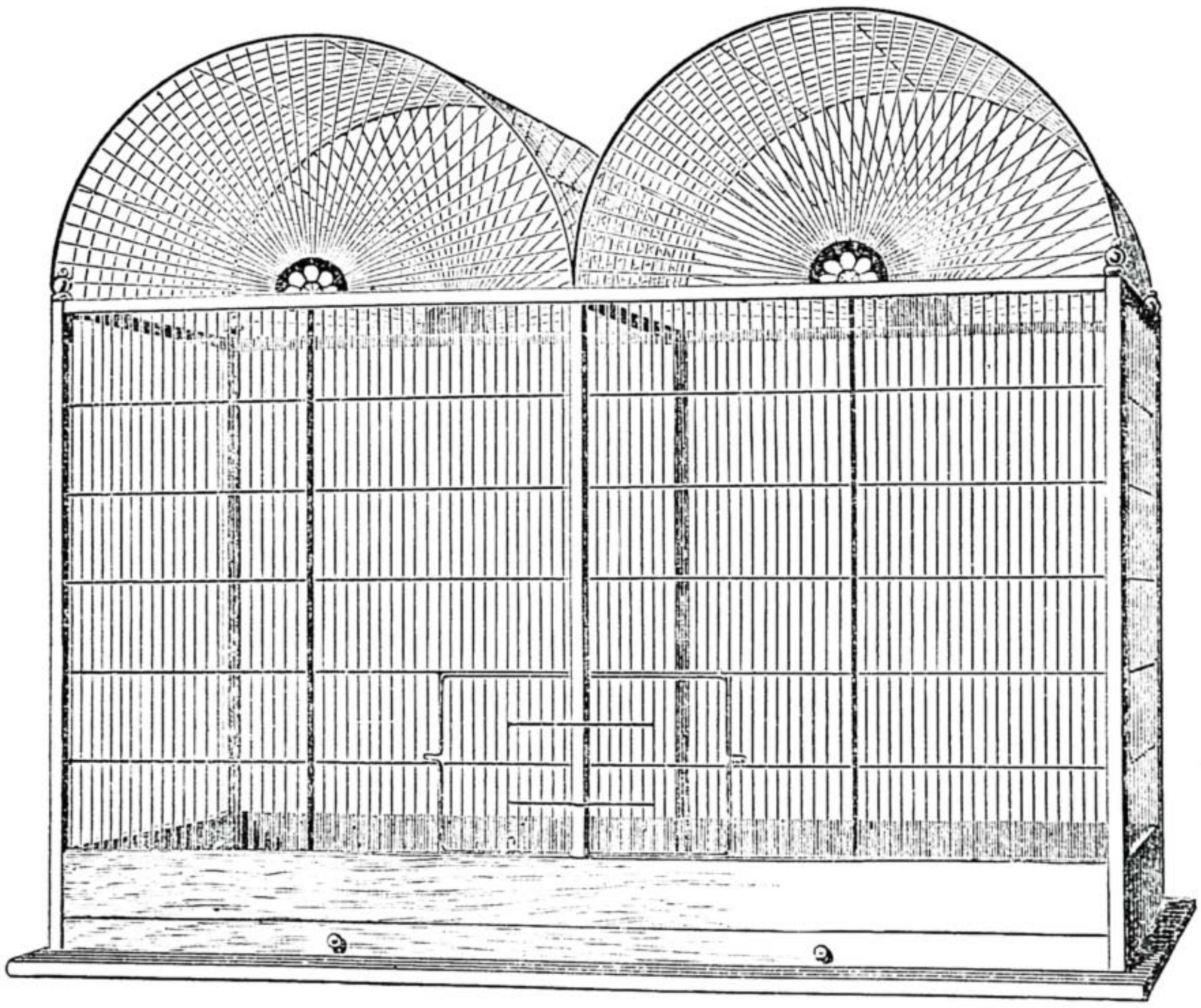

Fig. 1.—Breeding-Cage for Canaries of Wood and Wire.

the top; let it come within the two wires. Now take a piece of wire the right length (the straightened wire); pass it through the top hole, down through the middle piece, into the bottom rail. Now bend the piece that sticks up over the template, and cut it so that it will go nearly to the bottom of the hole—that is, only bore three-parts through. This is for the two sides. Now for the front and back. These should be passed through the top into bottom, and cut off at the top level with the wood. Now put the horizontal piece in and turn; solder over those pieces where it is left for the doors. And now for the top fronts. Take the template, and cut out room to let the small block half in;

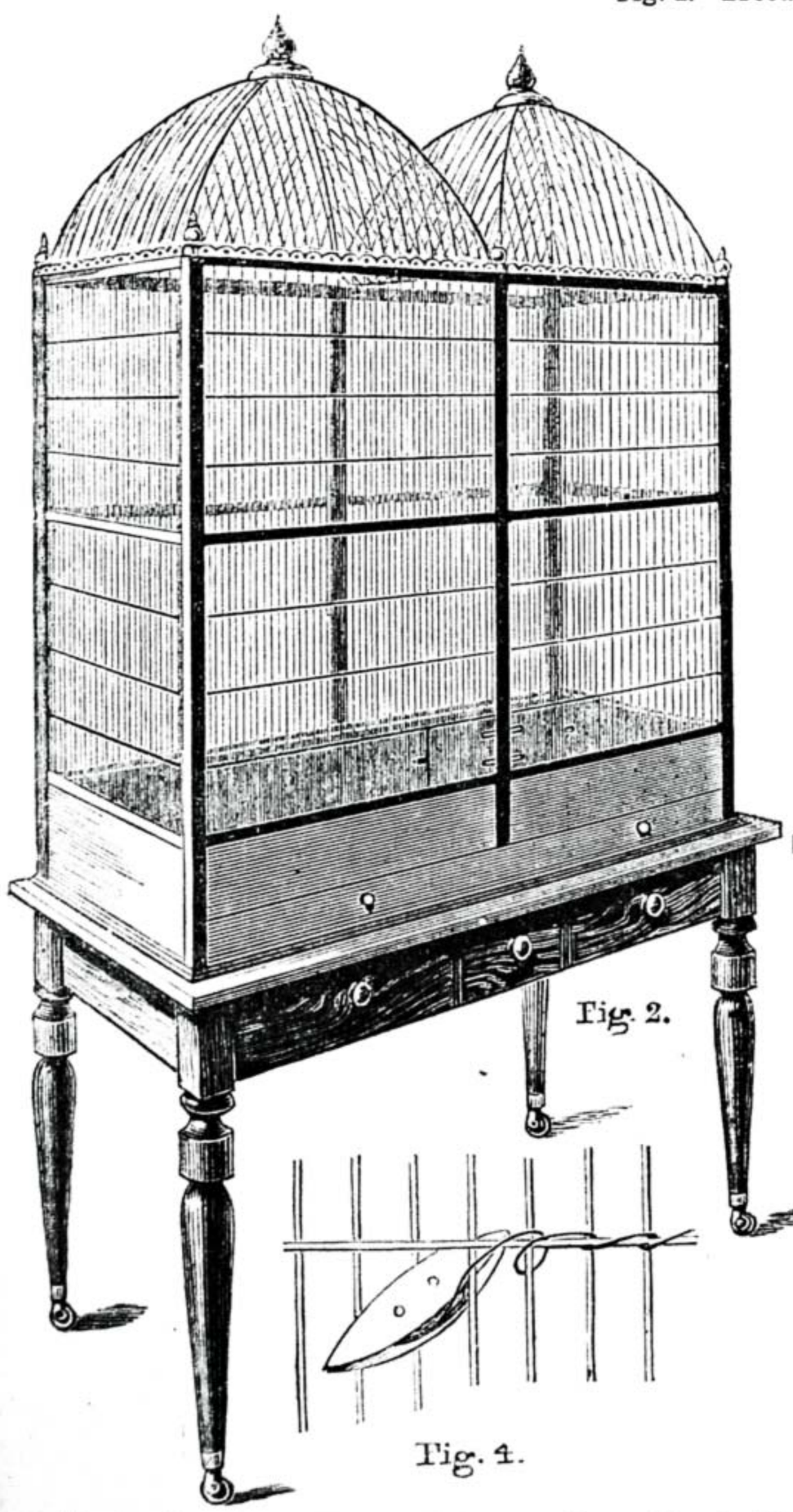

Fig. 2.

Fig. 4.

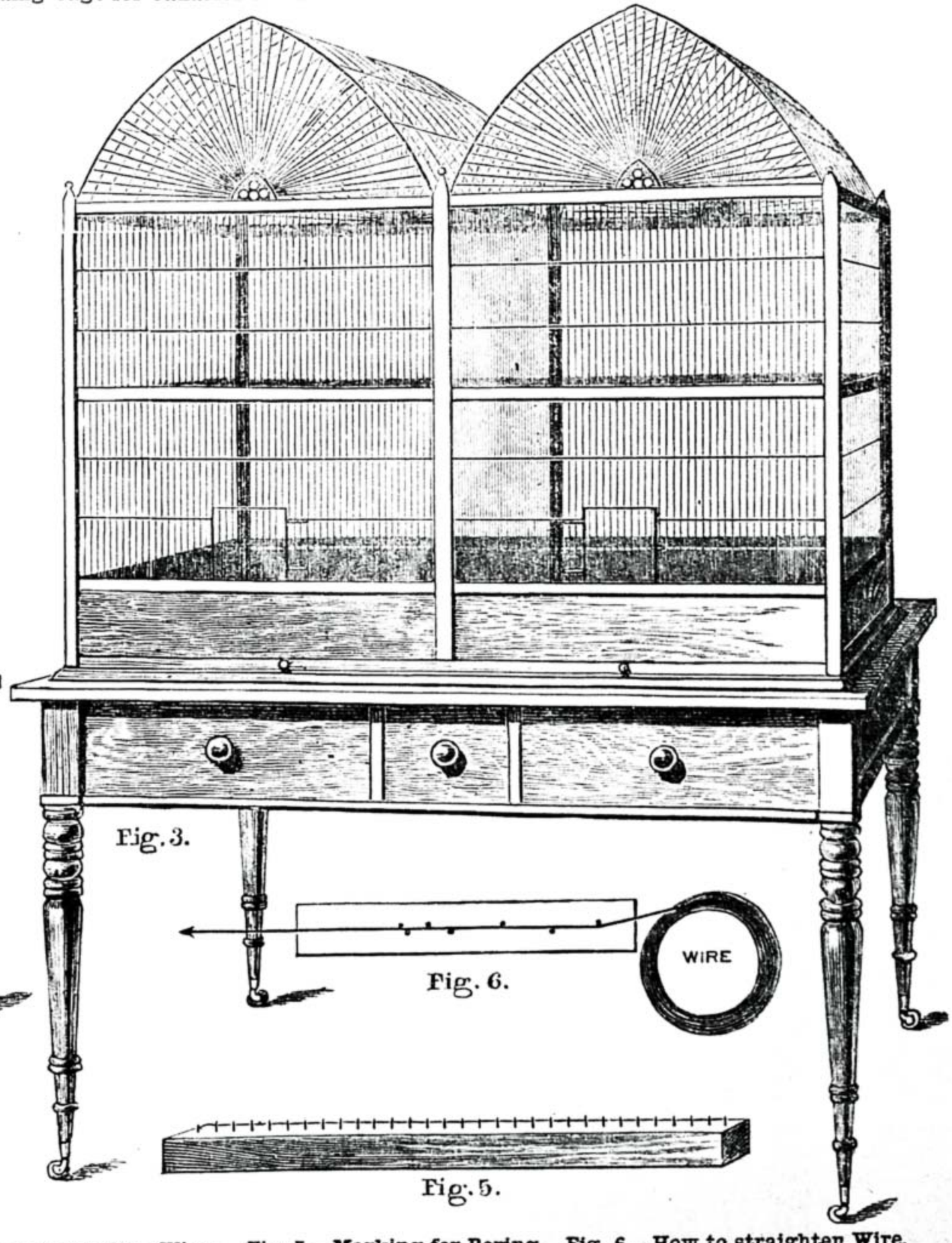

Fig. 3.

Fig. 6.

Fig. 5.

Fig. 2.—Zinc Cage. Fig. 3.—Mahogany Cage. Fig. 4.—Mode of binding Wires. Fig. 5.—Marking for Boring. Fig. 6.—How to straighten Wire.

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divide round the outside of the template five-eighths, and draw lines to the centre, and that will give you where to bore the holes. Place a piece of wire round the outside of the template; place wire in the holes; cut them of the right length; bend them over the outside wire, or solder them on, which, I think, is much the best (for soldering, *see* Vol. I., pp. 257, 503); place this on the top of the cage, glue the block on, and put the outside wire into holes bored for them. It is better, perhaps, to leave out three of the wires each end (say, one in the middle and one in the middle of each half); when it is fixed, take three wires long enough to go across the cage, and turn a right angle to go into the holes in the block. Now for binding the horizontal wires to the vertical ones. You can get binding wire at the same place. The way I have done this is: Fill a small bone tatting-shuttle with wire, and pass it through and through with one hand each side (Fig. 4); and when this is all done, and the wires are even apart, and the binding wire is pulled tight, it can be fastened in each post by boring a fine hole. Now make the doors, and fix them on to the centre-post, and fix on the bottom.

To make a metal cage, I should have half-inch angle bar, the joints to be soldered together. The wiring can be done the same as for a wooden cage running a tack of solder along the bottom bar to fix the wires. The whole of the cage could be made of zinc, and japanned before wiring, taking care to oxidise the zinc first with brine, so that the japan may stick.

If many readers wish for a more detailed description of any particular cage or an aviary, I should only be too pleased to give my experience in making canary cages. I have for the last five years made canary breeding and carpentry my hobbies.

BRICKLAYERS' WORK.

BY MUNIO.

Introductory.

Bricklayers' work is the art of erecting buildings, walls, etc., with bricks and mortar; it may be traced back to a very remote period in the history of the world; at the building of the Tower of Babel, 2247 B.C., burnt bricks were used. The Egyptians also employed the Israelites in making and building bricks; these were sun-dried, and mixed with chopped straw to give them greater tenacity; in consequence of the extreme heat and dryness of the climate, they acquired an extraordinary degree of hardness. Vitruvius writes of the Greeks using sun-dried bricks, and recommends them to be kept two years before being used, while the laws of Attica required them to be five years old.

The Romans used bricks extensively; they burnt them of a deep red colour, and the remains of their work which still exist, although over 1,800 years old, are little worse than when first built; it is most probable that the first bricks made in this country were made by the Romans.

Brickwork was not much used in England till after the Norman Conquest, and till the reign of Henry VIII. it did not attain to any great degree of perfection, but at that time many important buildings were erected which are still objects of admiration; the ordinary dwelling houses of this period were built of a timber framework filled in with laths and plaster, or brick panels, and called half timber work. But after the Great Fire of London it was ordained that bricks should be the material of the future city. Then brickwork began to be used in ornamental forms; it was carved and made to take the form which properly belongs to stone, pillars and rich entablatures being formed in it. The bricks of this period were thinner than they are at the present time.

The average size of bricks now made is 9½ in. long, 4½ in. broad, and 2½ to 3 in. thick, some clays contracting more than others.

About the close of last century a duty of 2s. 6d. per thousand was imposed on bricks. This was afterwards raised to 4s. Plain and paving tiles were taxed at 4s. 10d. per thousand, and pan tiles at 12s. 10d. per thousand.

In 1833 the duty on tiles was repealed, and that on bricks raised to 5s. 10d. per thousand, which remained till 1850, when the duty was entirely repealed.

Brick-making.

The process of brick-making varies very much in different parts of the country. In some districts the clay is ground between rollers, in others both rollers and pug mills are used. In the neighbourhood of London it is often passed through a wash mill; there is also great difference in the processes of drying and moulding. The forms of the kilns also differ very much. Some use the Dutch kiln with fire-holes at the sides and ends. In others the furnace is underneath the floor of the kiln; in Staffordshire circular-domed kilns called cupolas are used; in the northern counties a square kiln with arched roof is used, fired at the front; while in some places clamps are used, the fuel either being mixed with the clay, or spread in layers between the bricks.

Strength of Bricks.

Bricks vary very much in strength: in an account of some experiments given in the *Builder*, it was found that out of thirty-five different kinds of bricks which were tested, the average strength of the strongest was from 1,557 lbs. to 2,855 lbs. These bricks varied from 1½ to 3 in. in thickness, and the thinner bricks were stronger, in proportion, than the thickest.

It was also found that out of twenty-five different bricks from various districts, the average weight was about 7¾ lbs., and that the heavier bricks were the strongest; machine-made bricks are generally heavier than those made by hand. In some experiments made on the strength of hand and machine-made bricks with a hydraulic press, the pressure required to crack a hand-made brick was from 12 to 13 tons, while machine-made bricks required a pressure of 16 to 17 tons, and the pressure to crush a hand-made brick was from 14 to 25 tons, while machine-made bricks required a pressure of over 40 tons to crush them.

Machine-made bricks are heavier and less porous than hand-made bricks; they are more liable to crack in drying, but, on the other hand, they are much smoother than hand-made bricks.

The properties of good bricks should be soundness, and freedom from admixture of stones, or lime; they should be hard and well burnt throughout, and they should be uniform in size and colour, and should not absorb more water than one-sixth of their weight. The pressed bricks made at Ruabon, and some parts of the midland counties, are almost non-absorbent, and practically impervious to water.

Names of Bricks.

The bricks in general use are known as malms, grey stocks, red stocks, and place bricks; these are also subdivided into cutters, seconds, paviors, pickings, roughs, common, paving bricks, and clinkers.

Malms are made in the neighbourhood of London, and are of a yellow colour; they are used for best face work. Cutters are softer, and are used for gauged arches, and other rubbed work. Red and white Suffolks are also used for this class of work. Grey stocks are good bricks, but not of uniform colour. Red stocks are the ordinary red bricks made in different parts of the country. Place bricks are those left in the clamp after the malms and stocks have been selected. The seconds, paviors, pickings, roughs, and common, are selected after the malms and cutters are taken from the clamp; paving-bricks and clinkers are used for paving floors, etc. Gault bricks, made from Folkestone marl in various parts, are much used for facing; there are also numerous kinds of excellent bricks made in various parts of the country, and which would occupy too much space to be described here.

The colours of bricks are as varied as their names: there are reds, whites, greys, pinks, blues, blacks, the different colours being caused by the varying composition of the clays; thus, bricks made from a clay containing oxide of iron burn red; the Staffordshire clay burns red, but by additional heat being added, the blue colour is obtained.

Digging and Tempering Clay.

In commencing brick-making, the first operation is digging and tempering the clay; the earths or clays for brick-making are of three kinds: pure clay, composed of silica and alumina; marl, which contains a considerable proportion of lime; loam, which is sandy clay. It is seldom that these earths or clays are suitable for brick-making as found in their natural state, the pure clays requiring the addition of sand or loam, while the loam requires the addition of lime; the marl used in the vicinity of London is mixed with chalk ground to the consistency of cream.

The clay is dug in the autumn (the top soil being cast to one side), and wheeled into heaps, where it is left throughout the winter, which causes it to break up and crumble. In the spring it is turned over and tempered either by hand labour or in the pug mill, water being added to render it plastic; during this operation all stones must be picked out; when the clay contains gravel, or a great number of stones, it is washed in a large cistern filled with water, with a fine grating by which the liquid clay can be run off, leaving the stones; it is run into pits and left till sufficiently stiff for use. Some clays contain limestone, and should a piece of this get into a brick, it will sooner or later split it, or blow a piece out of it.

To counteract this evil, cast iron rollers are used in some parts to crush the limestone, and this in some measure remedies the evil.

In railway works, and some yards where the bricks are made by machinery, the clay is dug, passed through rolls into the pug mill, and through the brick machine at once, a mixture of sand or other material being used instead of weathering the clay during the winter; but bricks made in this manner often scale off after being built, causing the work to be refaced in a short

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time, although, when the nature of the clay is sufficiently known, by a judicious admixture very good bricks may be made.

The pug mill is a vertical cylinder, with a shaft in the centre, on which are fixed knives or cutters, which, revolving round, kneads the clay, and forces it through an opening at the lower end of the cylinder; it is worked either by steam power or a horse.

After the clay is tempered, either by hand labour or the pug mill, it is laid in heaps, and covered with mats to prevent its becoming too stiff for moulding.

Moulding of Bricks.

The brick mould is a box the size of the brick (or a little larger, to allow for contraction in burning), without top or bottom; it is sometimes made of wood, sometimes of brass, or of wood lined with brass. In the process of moulding, a table is used; the tempered clay is laid on one end of the table; the moulder takes a lump of clay of sufficient size in his hands, dashes it into the mould, pressing it well into the corners, and scrapes the superfluous clay from the top with a piece of wood called a strike. There are two kinds of moulding, known as slop and pallet moulding: in the first kind, the mould is dipped in water, contained in a box in the table, to prevent the clay adhering to the mould; in this case the mould is often carried to the drying floor and the brick turned out of the mould, a second mould being left with the moulder. Sometimes the brick is carried between two boards, instead of taking the mould, depending on the nature of the clay.

In pallet moulding, sand is used instead of water, and the bricks are carried off on one board.

The moulder generally works in a shed called the hovel, although sometimes in the open air. Adjoining the hovel is a level piece of ground called the drying ground. Sometimes a shed with flues underneath is used for drying the bricks more quickly, and preserving them from the weather, as heavy rain on the open ground soon destroys the fresh-moulded bricks.

When a steam engine is on the works, the exhaust steam can be turned under the floor of the drying shed, and utilised for drying the bricks; or, where practicable, the heat, after leaving the kilns, could be collected in a large flue, and, by means of dampers, distributed over the floor of the drying shed.

Drying.

The bricks are carried from the moulders by boys, and laid on the drying ground till one side is sufficiently dry; they are then turned, and when sufficiently hard, are built into walls called hacks, an opening being left between each brick. When the hacks are outside, they are covered with wooden covers, or tiles, to protect them from the rain.

Sometimes a barrow, called a hack barrow, is used to carry the bricks when the drying ground is of great extent, and some clays are sufficiently stiff to be built into the hacks from the barrow. The bricks are laid in two rows on the hack barrow on boards called pallet boards.

A good moulder will make over 1,000 bricks per day in slop moulding, and more than twice that number in pallet moulding, on account of having an assistant to make the lumps of clay ready for putting into the mould. The time required for the bricks to lie on the drying ground is from one to five days, depending on the state of the weather. In the drying shed less time is required; they then remain in the hacks from one to three weeks.

Brick Machines.

It is considered that making bricks by machinery on a small scale is not economical, as the cost of moulding alone is small in proportion to the total cost; but where there is a good bed of clay, and a large demand for the bricks, the use of machinery is to be recommended.

There are many varieties of brick machines, but they may be divided into two classes—wet and dry clay machines. In the former, the bricks are formed from tempered and plastic clay, under moderate pressure. In the latter, the clay is dry, or very slightly wetted, and the pressure is very heavy. Bricks made by the latter method are denser, and shrink less in drying and burning than in the wet clay process. The principle of the wet clay machines is to force the clay through a die, after which it passes between rollers, and is cut off with a wire. In the dry clay machines, the clay is forced into a mould. With ordinary-sized machines of either class, 80,000 to 100,000 bricks per week can be made. Pressed bricks are made by putting the hand or machine-moulded bricks into a metal mould when nearly dry, and, by means of a powerful screw or lever, they are pressed, which puts a very smooth surface upon them.

Polished bricks are rubbed on a bench plated with iron, and dressed with a beater or dresser by hand.

Burning.

After the bricks are thoroughly dry, they are put into the kiln or clamp and burned. The kilns are of various forms as previously named. The bricks are piled into the kilns, leaving a small space between each for the heat to pass through. The fire is applied slowly at first, till the bricks are thoroughly dried, which is known by the steam ceasing to rise; the heat is then increased, and if the kiln is open-topped, the top is covered with soil or sand to retain the heat. As soon as the bricks are sufficiently burnt, the fire-holes and all air-holes are plastered up, and the kiln allowed to cool slowly. The time for firing the kiln varies according to the number and size of the bricks in it. Great care should be used in piling the bricks in the kiln, as, when crossed, the exposed parts are streaked with white, and the parts in contact are red. In clamp burning in the London district, the fuel, which consists of sifted ashes called breeze, is mixed with the clay, a layer of breeze being spread between each course of bricks. The bricks are piled close, and the heat applied as in the kilns. Bricks made without being mixed with breeze are burnt in clamps, the fuel being small coals spread between each course. In the next article, the manufacture of fire-bricks, roofing and paving tiles, and drain tiles and pipes will be described.

THE MUSICAL BOX: HOW TO REPAIR IT.

BY A PRACTICAL HAND.

The musical box which some admire, some condemn because of the sameness. Nevertheless, a good one is delightful if not everlastingly kept going.

There is great cheating in them. A box 24 in. or 30 in. long may only have a 10 in. or 12 in. barrel, each end highly polished wood, bright levers, etc., to "do" the uninitiated. Such are astonishingly feeble for so large a concern, but "cheap" being the order of the day, they are got up for that purpose, eight or ten tunes, for the small sum of, say, £3 10s.; while a 24 in. or 30 in. box, with full-sized barrel and comb, 18 in. and 24 in., would be, say (polished rosewood, not stained), £6 and £8; £10 if extra finished.

To clean and repair one, first unscrew the four screws in outside of box, and then draw the two slides at each end inside; lift out of case entirely. Amateurs almost as a rule make this mistake, taking the fly wheel, etc., out, thereby destroying hundreds of pins on the barrel and damaging tips of teeth in comb. First see if the spring is down to the very *lowest* point, which it is almost sure not to be. For want of cleaning it will not probably be half-way, as the general public, either in case of watch, clock, or musical box, run them until they will do it no longer. Each article mentioned above would be more lasting, and give better results, if cleaned and oiled yearly.

Try the works now upon your bench. Help on the barrel, pressing from you the teeth of the wheel. Do not touch the pins. You will find it play on with this help. Keep occasionally trying slightly the reverse way to feel if fully down, and minus any force in it. Better this trouble than an expensive one by carelessness. I could mention a quicker way, but for the inexperienced it would be risky. Now with a good, strong, smooth-ended screwdriver, proceed to take out the eight or ten screws, with washers holding down the comb. Don't be afraid, but do it firmly, or you might slip, and it is sure to be at wrong side—away goes a tooth or two. Now unscrew the four screws holding the parts the barrel works in, and carefully prise each with point of screwdriver or stout blade of pocket-knife. Lift all out at once, having previously folded some soft clean paper pad-like, whereon to rest the barrel, so that no damage may be done to the pins. You can now turn over the frame, and notice underneath the three levers which change tunes, etc. Make a mark on each—1, 2, 3—so that you will not be puzzled when putting together, though you could not get wrong. Then unscrew the one screw holding fly wheel action part. Next unscrew the large drum containing mainspring, and the whole is ready to clean and repair. First examine barrel pins with your eyeglass fixed. Commence at the row of indents where the barrel always rests at end of tune. You can, of course, just slip the two brass parts into the frame with barrel without screwing, as they have holes and pins to fit, and keep in position. Now turn the barrel very slowly, and examine each row to see if any pins are bent down or to one side; if so, remember those pins take no part in the tune, and, of course, lessen the power of tone, causing what may be termed a thinness in places while playing. It is a slow and very tedious job, but when you have determined to put all into proper order, never mind the time or trouble—it will be worth your while. Have a thin-ended screwdriver, and when you see a pin bent out of position that the others are in, rest the point on the barrel, and very gently raise it to its original form. It may be a seriously damaged musical box—hundreds of pins flattened or gone: then it is a bad case; but if only a pin bent here and there, go all round the barrel and remedy, and even go over it again so as not to miss one, as it might be a particular note gone.

Now if, as I said above, it is a seriously damaged barrel, and you have abundance of patience and perseverance, procure some fine steel wire same size, to repin the barrel.

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Commence by taking the pin out at the end having the small toothed steel wheel which slides on to the square end of the part passing through inside of barrel; the spiral brass spring take off, and undo the end of barrel same as lid of barrel containing mainspring in watches. Draw out other wheel with axle rod affixed. You will now see inside a composition run all over the pins to fix them. This you must melt out by holding open end over a gas jet. Replace the rod and end cap of barrel, and place in the proper position on the frame, and with a very fine though strong steel punch and light hammer proceed to drive through the broken pins. Then cut your wire about half-inch lengths, and gently tap one into each hole about half-way. When all are filled, cut them off on the outside same height as the old ones remaining in. Be sure of this. If too short, they will not lift the teeth in comb, and thus prove dummy; and if too long, will lift tooth too high. Supposing all the pins are now reinserted, take out the rod and cap end, and use the following composition. What is used by the Swiss I do not know. We use this:—Equal parts of gutta-percha and resin, say 1 oz.; half the quantity of shellac, say ½ oz.; and a quarter the quantity of pitch, say ¼ oz. for a small box, or double these quantities for a large box. It will require to be ¼ in. or so thick inside.

Next, should the spring be broken, unscrew the patent winder and remove cap of barrel. Now comes a strong job to take out so large a spring, but do not be afraid. I lay it on the bench, and press down half the coils with a punch, and draw out the first unbroken coil with good stout pliers, slipping the punch nearer outer rim until I can handle the coil with my hand; then I seize barrel with the other, and, with a sharp "wiss," out it comes. Some fix the barrel in a vice, but unless very careful the barrel is marked, which always shows a tinkering job. If outside coil is broken at the hole, or near it, do as I mentioned about watch mainspring in Vol. I., p. 633; if inner coil, same. A new one will cost from 1s. 6d. to 3s. 6d., according to size, of course; small boxes 9d. If the new spring is same width and strength, fit in as stated for watch spring. Hold firmly down while turning in each coil. Should the patent winder ratchet part be out of order, repoint smoothly and neatly the click, as it will be worn; or if click spring is broken, make one like it from a piece of good steel spring; drill hole, and rescrew it. Should a tooth or two be broken on the spring barrel, file them away, make a good dovetail as at A (Fig. 2), and with a good piece of hard brass (rotten cast trash will not do), hammer it well, and fit as described in directions for watch wheel repairs (Vol. I., p. 633).

You must unscrew B (Fig. 2) from the stop action, so that in the fixing of new spring this must be at rest upon the double tooth, C, and the mainspring must have about two turns—or even three—to carry the tune to end. In finishing this you will see, when all is complete, that

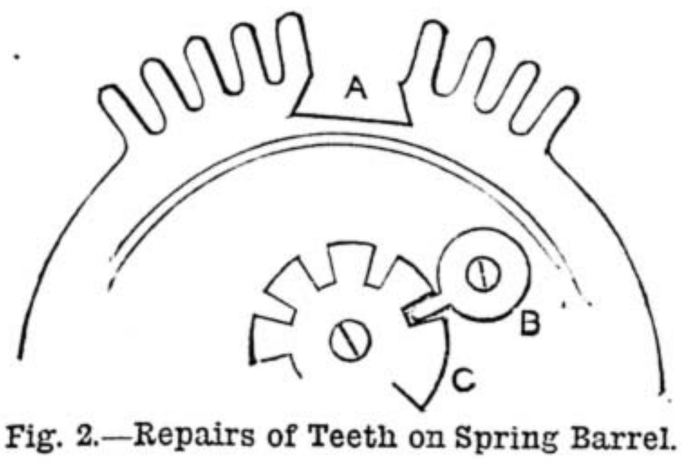

Fig. 2.—Repairs of Teeth on Spring Barrel.

it prevents you from overwinding, as in a horizontal watch.

We now turn to the comb—the most difficult job of all, for if many teeth are minus, it is no good. Should an odd tooth here and there be out—well, if you have the broken ones, solder them underside for appearance' sake only, for they will not speak again. If you have not the original ones, file imitation ones near like as possible, and solder too. I have seen it stated that speaking teeth can be affixed. Believe it not, for I tried the best professors. The sound of such teeth is a flat, dull sound.

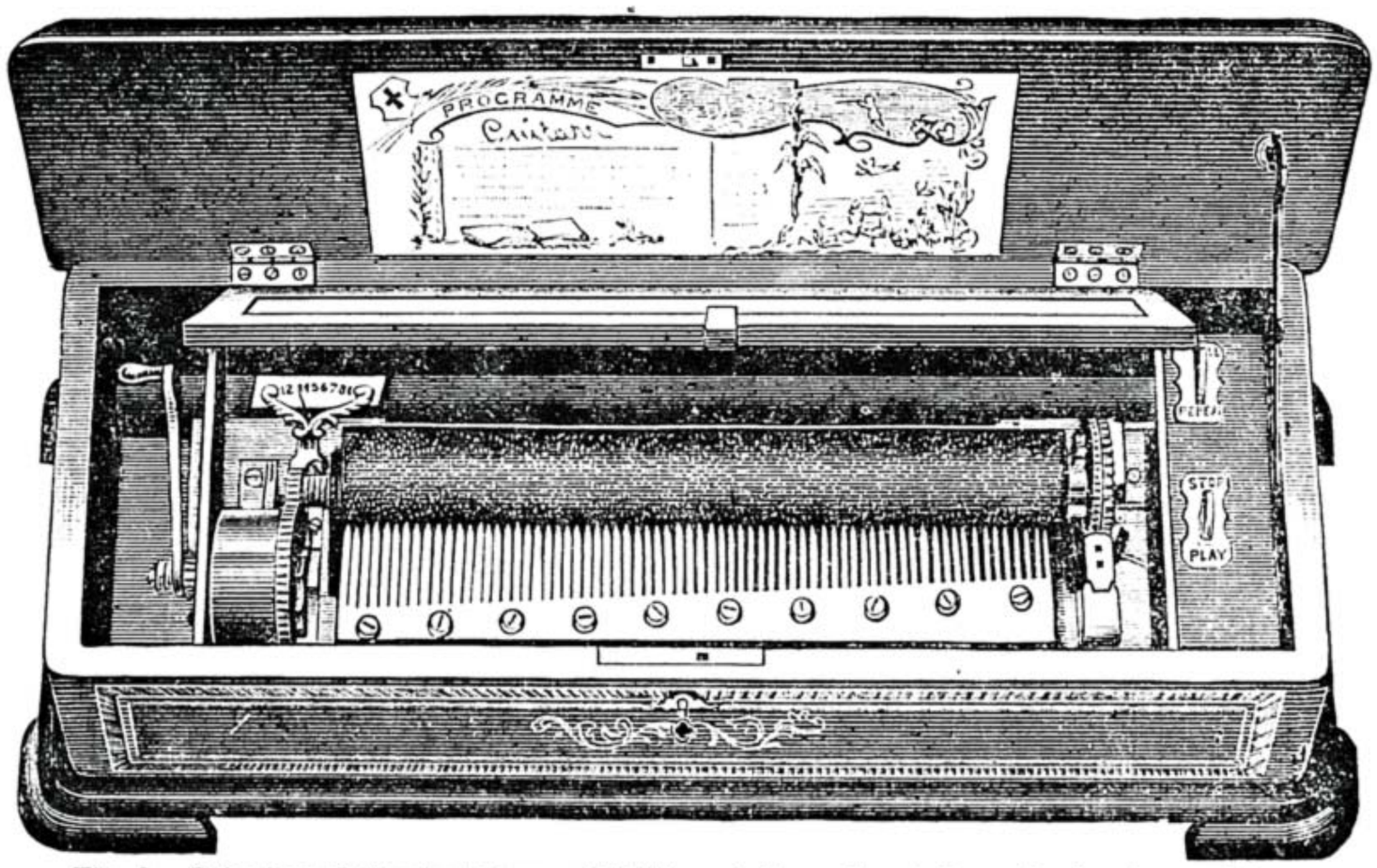

Fig. 1.—Interior of Musical Box, exhibiting Action, Comb, Barrel, etc., in position.

An odd tooth or two out, if *not* together, does not perceptibly interfere with the music, seeing that two teeth have the same, or nearly the same, tone. However, that is the best you can do, and if comb is badly damaged, it saves no end of trouble and expense to get a new one. You can give it a trial, and experience will teach. In case the action part is out of order, and the endless screw with fly attached is out of order and will not turn, see if the top end stone, A (Fig. 3) is cracked or broken; if so, the fly will not run with ease. Take it out and procure a new one. Or the endless screw may be worn. See if it is. Use your eyeglass. Try, by pushing the largest wheel,

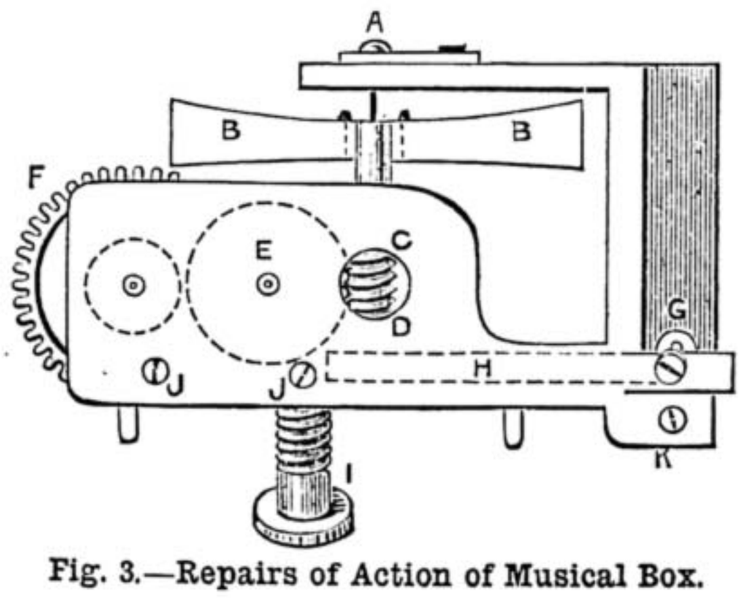

Fig. 3.—Repairs of Action of Musical Box.

F, towards the endless screw, D, and notice by holding it betwixt your eyeglass and the light, looking through the hole C. See if wheel, E, runs easily in the worm, D, or if worm is worn. See if flys, B, B, run clear, and not touch in the least (they may do, by frame having had a knock), or if any tooths in E or F are bent or injured. Now, should the worm be worn, unscrew J, J, and it will be apart; and unscrew K and let out fly. Then with a smooth thin file neatly go round the worm or screw, and after making quite smooth by burnishing it, the teeth of wheel, E, may require retouching, keeping same shape; then burnish. Now clean perfectly, frame and all, and replace. Of course you will find the wheel, E, has not the same dip into the worm, so give the screw, G, half or quarter turn to the right. Now see if near enough, but keep turning the large wheel, F, and turn screw, G, in or out, so that all works easy; if so, it is complete. Oil it, a small drop to each, and one to worm; also its top pivot. I is large screw for fixing to main frame; dotted lines show how H slides in or out by turning G; the other dotted lines wheel part inside of frames.

Now clean all well; very fine emery-paper to comb. Push towards points of teeth always, so that no mark crossways will show. Then slide a card betwixt every tooth, to clear out grit from the loaded teeth—under points of teeth. Be careful of small springs. Any broken replace with bent hairspring from watches, pinning in as before. (These act as dampers in a piano.) Clean barrel in frame with a brush and chalk (prepared chalk) Brush *around*, not across until it is like new. Here replace mainspring part with its four screws, then barrel and the fly action part, last the comb. Be sure to screw up *tight* for a good tone. Turn it on the side comb is on, and replace levers underneath. Having oiled the barrel, wheel, pivots, and mainspring parts, the action is already done. Now wind up a few turns, and let it play. The tone will be poor, but it is not in the case. Now see if it turns cheerfully down to last double tooth in stop action at C; if so, it is right. If not, unscrew B and turn up patent winder until sufficient power is on, then replace B, and it will be right, no doubt. Replace in the case, screw up tight with the brass washers on, and replace slide ends, having seen that the starting changing levers are acting (you will easily see this), and the part which stops it at the end of any tune. Finally wind up, and your labour will be well spent.

CARVED WOOD COVER FOR "WORK."

BY F. W. KINNEIR TARTE, M.S.A.

THE accompanying design is for a carved wood cover for WORK, preferably in oak; but the cover might be carved in any other wood suitable for carving purposes. If pine, or a white wood is selected, I would advise that the cover after being carved should be stained with walnut stain. "Jackson's

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CARVED WOOD COVER FOR WORK.

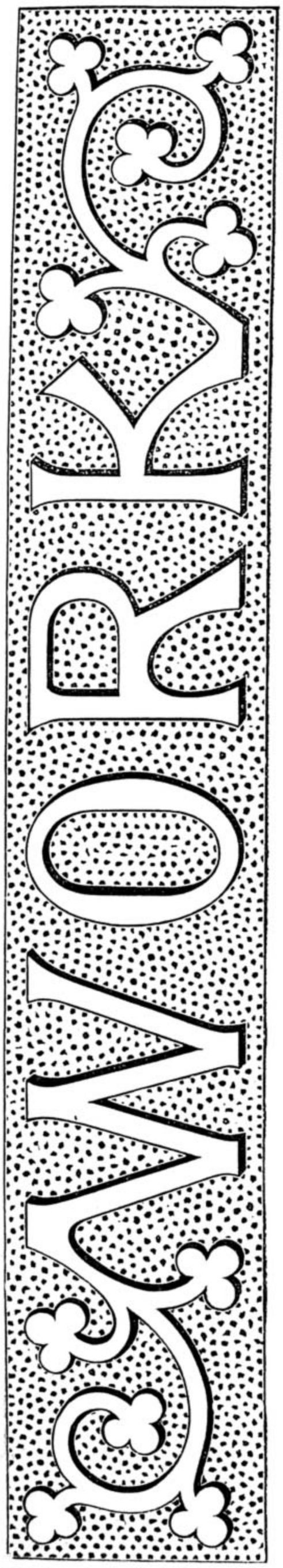

Fig. 3.—Central Portion of Cover (full size).

DESIGNED BY

F. W. KINNEIR TARTE, M.S.A.

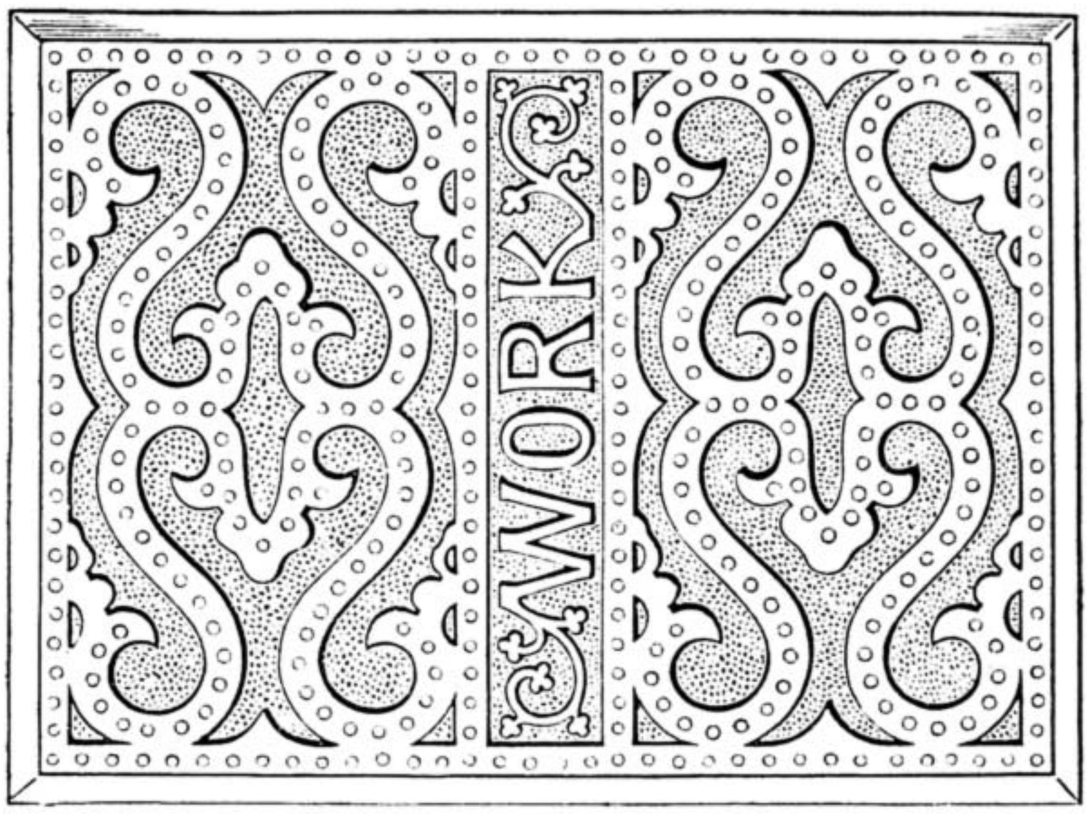

Fig. 1.—Diagram showing Entire Cover. (Scale, one-quarter full size).

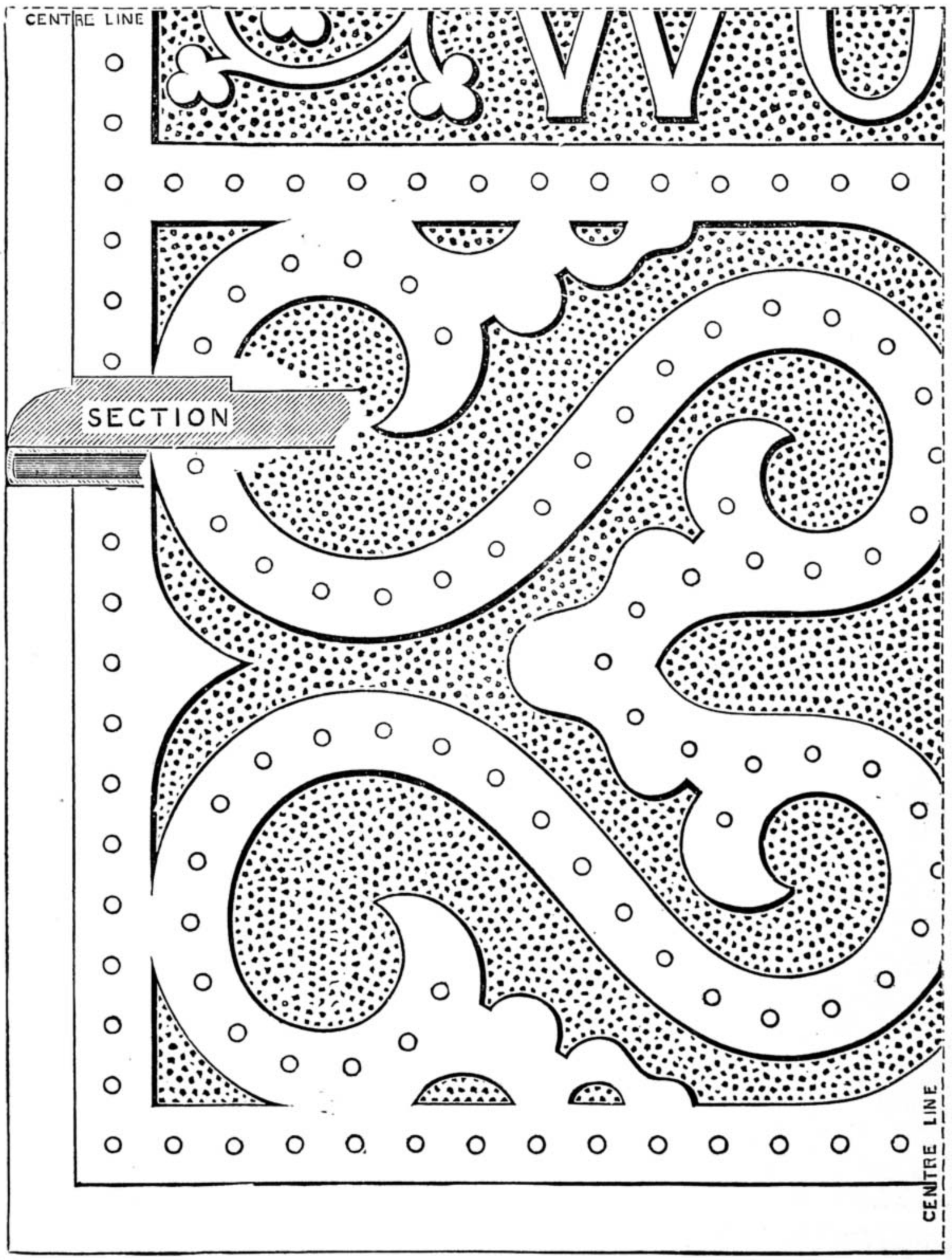

Fig. 2.—One-fourth part of Cover (full size).

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Walnut Stain" is a rich brown colour, which greatly adds to the charm of white carved woods. Two coats will be found to be sufficient, but each coat should be laid on sparingly and well rubbed in with a stiff brush.

The size of the wood cover when finished should be 9¾ in. broad by 13 in. long, and the thickness ½ in. or ⅜ in. when planed up ready for carving. Fig. 1 is a quarter full-size plan. Fig. 2 is one-quarter of the cover full size, with the section showing the under cover. Fig. 3 is a full-sized detail of the lettering and sprays in the centre of the cover.

The dotted portion should be cut out about the eighth of an inch deep, leaving the lettering and design in relief. The ovolo moulding around the edges should next be worked, then the ground should be punched, and the circular punch marks on the design should be placed at fairly regular intervals.

With regard to the making up, perhaps a few hints may not be out of place. Serge makes a good undercover, and should this material be used, take a piece 13 in. by 19½ in., fold this in two, enclosing a piece of cardboard rather smaller than the wood cover. The front edge, the top, and the bottom should now be bound with ribbon. You will then have a serge back cover the same length as the wood cover, but 1 in. wider. After stitching the edges together turn this inch up, and glue it along the under back edge of the carved wood cover. Now all that remains to complete is to have a piece of ribbon or elastic, 13 in. long, sewn on the inside back of the cover at the top and bottom, leaving the middle loose so that the paper may be removed at pleasure.

Carved wood book covers always pay for the time spent on them. They are satisfactory things to carve, for they require but little making up, and, in a great measure, keep papers tidy, and diminish their chance of being lost or damaged.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

3.—The Patent Portière, or Self-Acting Door Curtain Rod.

There must be few who will not readily acknowledge the advantage of curtains at doors and windows as a means of excluding draughts and inconvenient currents of air in wintry and windy weather, and there will be as few, doubtless, who have made use of curtains for doors, whether within the room or without the room, who will not allow that the means of lessening the inrush of air by hangings is also attended with inconvenience, caused by having to push the curtain aside both on entering the room and on quitting it. It will have occurred to many, perhaps, that it would be an advance in the right direction if, by some contrivance, the door could carry the curtain with it when opened; but to bring it about has been an insuperable puzzle. It has been solved, nevertheless, by the ingenuity of Mr. Lawton, and a portière, or self-acting curtain rod, has been made, on what is termed the Duval-Lawton patent, which provides for ingress and egress through a curtained door without the slightest trouble. A glance at Fig. 1 will show how this is brought about. There is a joint in the rod at A, and as the bracket, B, is screwed to the jamb on which the door is hinged, and the bracket, C, to the door itself, at the topmost corner of the free side, it will be understood that, as the door is opened, the rod turns on the patent joint at A, and that the opening of the door is effected without disarrangement of the curtain. When the door is closed, the parts of the rod resume their original position, and fall into the same straight line, and the curtain also is as it was before the door was opened. Each rod is fitted with a patent joint and patent bracket that absolutely guarantees the firm holding of the rod in its proper position. Being manufactured solely in wrought metal, it is of superior strength to the usual article fitted with cast brackets, and being machine made and well polished, it is turned out well finished, and in a manner which ensures easy working. The rods are made for right- and left-hand doors, and, in purchasing, care should be taken to mention how the door is hung, so that the rod supplied may be suitable for it. Rods may be had in three sizes, namely, ½ in., ⅝ in., and ¾ in. in diameter; and each is sent out complete with ends, rings, and brackets. They are manufactured by Messrs. Williams Bros. and Co., General Brass Founders and Tube Manufacturers, Pershore Street, Birmingham, who only supply through upholsterers, ironmongers, and dealers. The patent joint used in the tube may be inserted in any tube or rod where a joint is required. I do not know the prices of the rods.

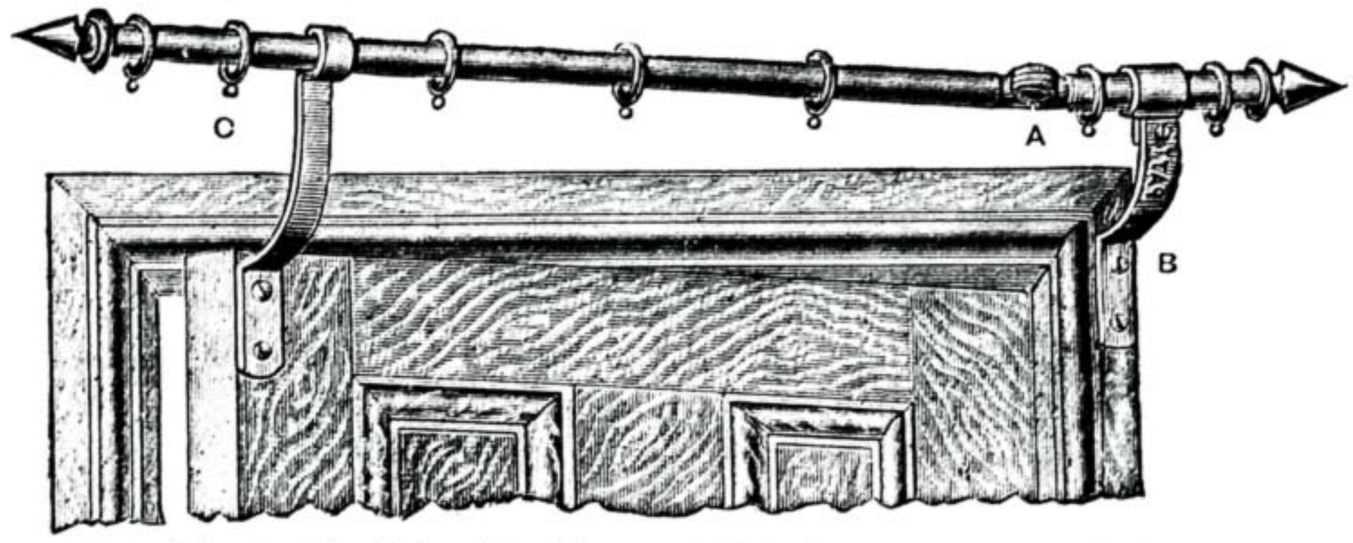

Fig. 1.—The Patent Portière, or Self-Acting Door Curtain Rod.

4.—Hodges' Mitre Shoot.

Many aids and appliances for frame-making and for making correct mitre joints have been given to the working public of late years, and the latest addition to their number has been Hodges' Mitre Shoot, which is illustrated in Fig. 2, and which is intended for planing up the joint after the wood has been cut to the proper shape by means of the saw. The patent rights are held by Mr. E. R. Sibley, Whites Hill, near Stroud, Gloucestershire, who, I am sure, will readily answer any question regarding the price at which the machine is sold, and respecting which I am utterly in the dark. I like to be in a position to mention the price of everything that I am called on to notice, for to know the cost of an article is useful to buyer, seller, reader, and myself all round, and, in many cases, saves the putting of questions on this point and the answering of the same. The nature of the machine will be seen from the illustration. First, there is a rectangular frame or bed, with raised edges or guards, which is fixed firmly to the edge of the work-bench, as shown, by two screws. Attached to the frame is an adjustable bed, whose inclination forms an angle of 45° with the frame, and on this frame the moulding is placed after being cut in the mitre block, and secured by the vice, which grips it and retains it in position, the vice itself working in a small block attached to the adjustable bed. When the moulding is in position, the end may be planed up with the long plane shown in the illustration, and which is made of so great a length that it may be able to ride on the guards formed by the raised edges of the frame and the top of the bed itself. As these guards are perfectly flat and square, it follows that the end of the moulding, when planed up, must be equally flat and square. The bed, as it has been said, is adjustable, and should it deviate from the proper angle, it can be set correctly by loosening a screw at the back of the regulator, bringing it parallel with the sides of the machine, and then tightening the screw again. The regulator is at the bottom of the bed, and does not appear in the illustration. The points of utility claimed for the machine are, its capability of producing accurate work; causing no injury to mouldings; perfect adjustment by means of its rising and falling bed; the ease with which it can be worked; the possibility of reshooting the ends of a frame after two sides have been joined together; and its portability and the ease with which it is fixed. The machine takes mouldings 4 in. wide and 3 in. deep. The Editor.

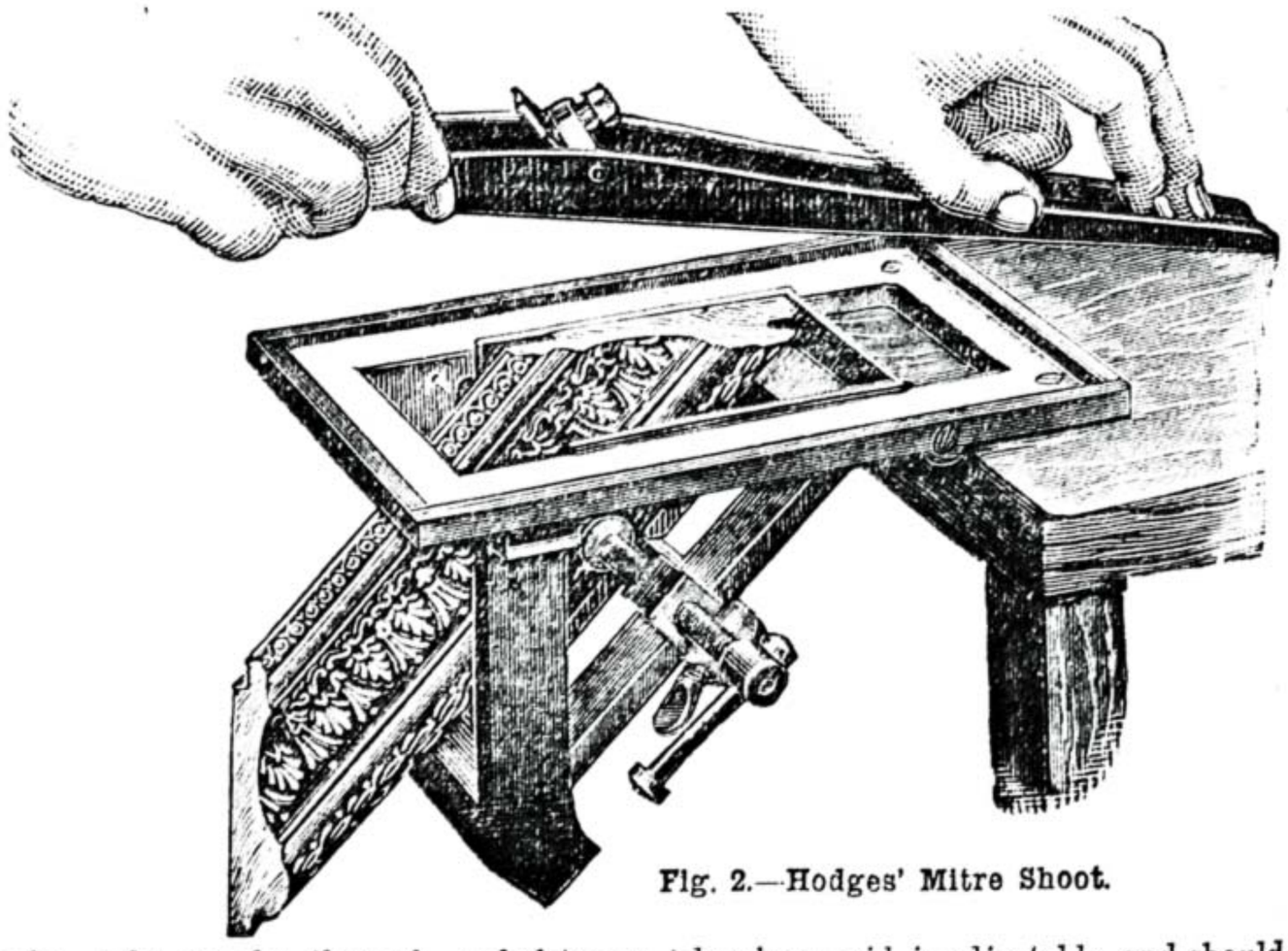

Fig. 2.—Hodges' Mitre Shoot.

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SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

NOTICE TO CORRESPONDENTS.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

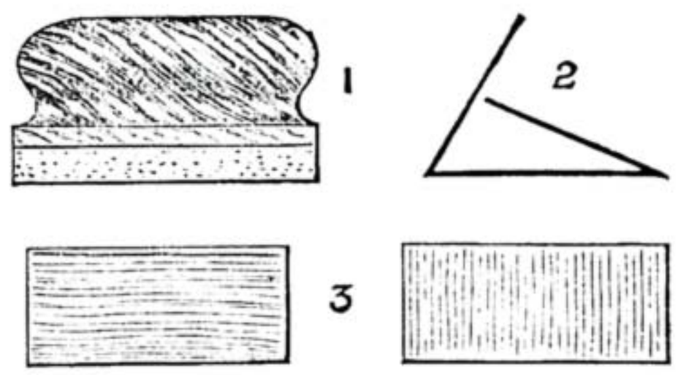
I.—LETTERS FROM CORRESPONDENTS.

Misuse of Terms.—B. A. B. (*Hampstead*) writes:—"Permit me to answer H. B. (*Jarrow-on-Tyne*) (see page 779, Vol. I.). I am fully aware that H. B.'s way of holding the chisel does tend to liberate the core, and it is therefore no news to me, but I maintain that the accuracy of the mortise is more easily and surely obtained on my plan; besides, H. B. must sooner or later reverse the chisel to finish the mortise, and then his own objection to my plan applies to his procedure. He may have 'always understood that wood was bored, but that metal was drilled,' but I can assure him no competent instructor ever taught him that the distinction depends on the material operated on. He evolved the information out of his inner consciousness. Further, the term 'munting' is usually applied to the *inner* vertical parts of a piece of framing; the *outer* vertical parts are called 'styles.' 'Mullions' are the central vertical parts of windows, in which H. B.'s knowledge appears to be correct, though he wishes to be more correct than his dictionary. Here again H. B. appears to believe that the name depends on the material, and his expressed doubts as to the correctness of his dictionary spring from that idea which he has formed. I am quite willing to admit that the term is probably a workman's word, many of which spring from verbal corruptions. Mr. Adamson, I think, believes the word is a corruption of 'mounting;' it may be, or it may be a corruption of 'mountant,' especially as the 'g' is scarcely ever sounded. Be that as it may, the term is well understood, and we shall use it until a better word is found for us to use."

Gesso Work.—C. W. (*Kensington, W.*) writes:—"Will you permit me to say a few words upon gesso decoration for furniture, etc? On page 755, Vol. I., there is an article by E. C. upon this subject, in which the writer says:—'I cannot doubt that any one who can execute gesso work well would have a fine chance of doing a good business with some of the larger furnishing and decorating firms.' This is so far from being the case, that an artist, whose beautiful panels attracted considerable notice in the Exhibition of the Arts and Crafts last year, and whose proficiency can be vouched for by some of the highest in the profession, has applied to many of these firms in vain for an opportunity of showing how beautiful furniture in satin and other ornamental woods can be made by the addition of panels of gesso, much in the same way as small pieces of Chinese lacquer were formerly applied, and also how whole suites might be coloured and lacquered to suit the drapery and decorations of apartments. There is no reason why such furniture should not be as valuable and as attractive as painted satinwood or *vernis martin*; but, unhappily, our furnishing firms have not sufficient imagination to see in their 'mind's eye' the effect to be produced, or perhaps not enterprise enough to venture upon a complete novelty; thus, while copies of old furniture meet with ready sale, original work, however beautiful, is thrust aside without notice. Although much has been done by the Arts and Crafts Exhibition to introduce such works to the public, it requires a cabinet maker's or furnishing firm to take up the matter, in order to show the full value of the material, and, knowing its capabilities, I think I may say there is little fear of disappointment with the result."

Home-made Articles.—H. G. (*Bishopsgate*) writes to B. G. S. (*Dover*) (see page 779, Vol. I.):—"Bravo! Your sarcastic criticism is worth reading. According to your idea, it is impossible to do any work unless we have an elaborate set of tools. I don't think you know much about woodwork though, or else you would have been more lenient in disbelieving. The reason I sent the sketches (*not* done on tracing paper) was not to praise myself, but so as to give correspondents an idea how work can be done, and done well, with a few tools, although the work is tedious and takes a long time to do. As regards the spindles, I bought them; any person with common sense would know that to turn them you must have a lathe. If you read page 636, Vol. I, again, you will find—I refer to the dresser and perambulator being made with the keyhole saw, etc.—that at the time I made them I had no more tools in my possession: it was not from choice, but from necessity. Of course, now I have plenty of tools, and, as you don't believe I made all those things stated, I must add that I have gone in for picture-frame making and mount cutting; what do you think of that? Of course, seeing is believing, and if you or any one else wants my address, and the Editor is kind enough to give it, come and see me any night after seven, and I will show you how it's done."

Some Hints from New Zealand.—JOINER (*Taranaki, New Zealand*) writes:—"I had my attention drawn to your publication WORK by a subscriber as a work that will be useful, not only to the amateur but to the tradesman. As one of the latter class, I fully endorse the opinion, and, as a subscriber now, I trust you will keep up to the standard for the sake of those who, like myself, are far away from the many advantages that a home-stayer has over the wanderer, as regards the new tools and appliances, of which we have often to be content with the notices and description only, which, however, are suggestive to the practical mind. Your various writers will please excuse me offering a suggestion as regards their methods of how the work has to be done. Don't confuse by trying to make it too plain, and above all things be workmanlike. Show how the article would be constructed by a tradesman—viz., framings mortised or dowelled, and not halved together, drawers, etc., dovetailed and not simply nailed, and so on. If it is worth making it is worth making well. My reason for mentioning this is that amateur work, as a rule, is jerry-built, and hardly a pleasure to look on. Also that he is apt to think little of a tradesman who, perforce, must construct on proper lines, whilst if the amateur learnt how to work he would appreciate good work when he saw it, and give more honour to the maker when he himself understood the accurate and nice work requisite to complete it as a whole; and to the amateur I would say don't be satisfied with rushing through a lot of things. Rather be a year making one article well, than make twelve in the same time that are neither of long service or ornamental by reason of their sloppy character. Be patient and painstaking, and the results will follow. I shall have much pleasure at times in offering suggestions, and trust they will



Diagrams illustrative of Use of Glass-paper and Stencil Cutting.

be taken in the spirit they are offered—viz., to do an all-round good. And now for number two. In the first place, as regards the use of glass-paper, my experience has been, even with tradesmen, that few know how to hold it. In the first place, you want a proper rubber, and in practice I have found that a piece of Honduras or clean pine, 5¾ in. by 2¾ in. by 1 in., with a piece of sheet cork glued on the face, and finished on the edges with a hollow, as in Fig. 1, is about the handiest form for general use. Fold the glass-paper and tear in two parts, giving you two pieces each 10 in. by 6 in. Then fold each piece twice, as in Fig. 2, and you will find there will be no slipping. The same rule can be followed in smaller pieces for using with fingers for cleaning up work where the rubber is not available. Secondly, as regards stencil cutting, I have at times been surprised, whilst reading works on decoration, that the writers advocate cutting stencils with a knife out of prepared paper, a job requiring an amount of dexterity, and also embodying the liability by one false cut to spoil the whole. My plan is to cut them out of zinc (the size or gauge used for lining export packing cases) with the fret saw, with the advantage that you can duplicate or quadruplicate if necessary. Get as many pieces of zinc as you require, lay a piece of greased paper (mutton fat is the best) between each piece, and fasten rigidly between two pieces of thin board, and, by the way, cross the grain of the wood as in Fig. 3, and you will in practice find the advantage. Paste on or transfer your pattern, drill the holes, and after cutting take apart. Clean off both sides with emery cloth, then with a sharp penknife and buhl files clean off irregularities, and you will have a set of stencils that will give every satisfaction by reason of the thinness and consequent clearness of outline. Wash clean after using, and either hang up out of harm's way, or keep in a book. I always follow this plan for fret cutting, placing the zinc for stencil between the two first pieces I cut; and fret cutters will find it save an infinity of trouble in copying or transferring patterns, with the further benefit that you can stencil on the wood, and if for polished work, polish over it before cutting. One caution only I give. Use coloured stencil inks, and never black, or you will find it trying to the eyes in following the pattern. With regard to the number of stencils to be cut at one time, that depends on the capabilities of the machine. Mine is a 'Fleetwood,' and with a No. 1 Star saw I have cut as many as four at a time out of No. 8 zinc. I wish you every success."—[I give your letter *in extenso*, as it contains many useful hints and suggestions, and is especially welcome, as it shows that WORK has taken root in the Antipodes, and is valued there.—ED.]

Glue for Earthenware.—M. R. (*Burnley*) sends the following recipe for a glue for earthenware, but omits to state the source of the cutting:—"Put a piece of white flint stone into the midst of a fierce fire. When it is red, or rather white, hot, take it out with a pair of tongs and suddenly drop it into a pan of cold water, which should be placed for the purpose. This will destroy the power of adhesion in the flint and precipitate the stone to a fine powder, from which the water must be carefully poured off. Now melt with white resin in an iron pot, and stir the flintstone powder in it till it becomes a thick paste. Warm the edges of the articles to be mended, and join neatly together."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Phonograph.—E. B. W. (*Nottingham*).—It is a difficult matter for me to give you a sufficient answer to your query, you ask so little. It is not always so with querists. Some querists when asking for information do so in such a manner as to lead one to suppose that they are quite adepts in the subject at issue, and that giving them information would be like throwing water on a drowned mouse. How different is it in your case. You ask what kind of diaphragm, and what kind of wax to use in making a phonograph, and from that question and your little postcard, I have come to the conclusion that you require a great deal of information on the subject. However, I must keep to the point and answer as you have asked. The diaphragm is not always made of the same material. I used for a long time a ferrotype plate for this purpose, but now use a parchment diaphragm. The ferrotype seems to be a little too stiff, and the parchment if too thin is just the opposite. In Edison's new phonograph the diaphragm is of mica. You have the choice of these three. About the wax. The wax that is used is paraffin-wax. I do wish you had asked a little more, I would have been better able to advise you. I am going to prepare an article on the phonograph, in which I will give working drawings, which I am sure will be useful to many readers of WORK, if our Editor can find a corner for the publication of it. In the meantime, if you want any further information do not be afraid to ask. I would rather see a sheet of foolscap filled with questions than a *petite* post-card.—W. D.

Re-stringing Tennis Racquet.—W. H. (*St. Leonards-on-Sea*).—It is quite impossible to re-string an old racquet satisfactorily, for the simple reason that the bow when originally strung is fully an inch in depth at the top, being fined down to three-quarters of an inch after being strung. It is still then strong enough to bear the all-round strain, but is not sufficiently strong to resist the severe pressure of the commencement of the process, without deflecting the shape. The stringing is commenced by leading the two ends of one piece of gut down through the two centre holes on the top of the bow, and through the two centre holes in the handle piece, and these strands are drawn tight by being wound over a round piece of soft wood, when they should be temporarily secured by a pin till the next strands are secured. The cross-stringing is commenced in the same manner through the two centre holes on the side of the racquet. After completion the gut requires one or two coats of varnish or French polish applied with a camel-hair brush.—C. T. S.

Electric Light for Model Eiffel Tower.—A. P. M. (*Richmond*).—This correspondent has made a model of the Eiffel Tower in fretwork, and wishes to know whether it would be possible to introduce an electric light in the lantern at the top, and feed it by means of a small dynamo concealed in the base of the model. The model and idea of lighting are most creditable, but the light should be fed with current from a small box battery, rather than from a small dynamo. Four small cells, such as those described in my article on "Model Electric Lights," which will appear shortly, will light up a 6-volt 5 c.p. electric lamp placed in the lantern. The cells may be placed on the first platform, concealed behind the legs or pillars. A lifting arrangement for the battery may be worked by means of cords and pulleys running up the interior of the model. Insulated wires, No 18 copper, cotton-covered, will connect the lamp with the battery. The whole, lamp, battery, wires, etc., will cost a little under £1. If you write to Mr. Bottone, Carshalton, Surrey, I think he will give you full instructions, and supply you with the materials.—G. E. B.

Where to Buy an Alarm Battery.—J. A. B. (*Poplar*).—I do not know your locality, so cannot tell you where you can buy a Leclanché battery after six o'clock in the evening, or after two o'clock on Saturday. In my neighbourhood, the cells and other electric bell fittings are sold by ironmongers. Messrs. H. Dale & Co. will, doubtless, send you a battery by carrier, if you write to them. I do not think very highly of your idea for an electric alarum. There would not be power enough in the hour hand to press the springs together. Why not try the method described and illustrated by me in my article, "An Electric Time Alarum"? My own clock is fitted up in this way and gives every satisfaction. As you are a brass finisher, you could make a thorough good job of it, even better than myself. For full details respecting the switch and mode of connecting up the battery to the clock and bell, see my reply to ONE IN NEED (*Coventry*).—G. E. B.

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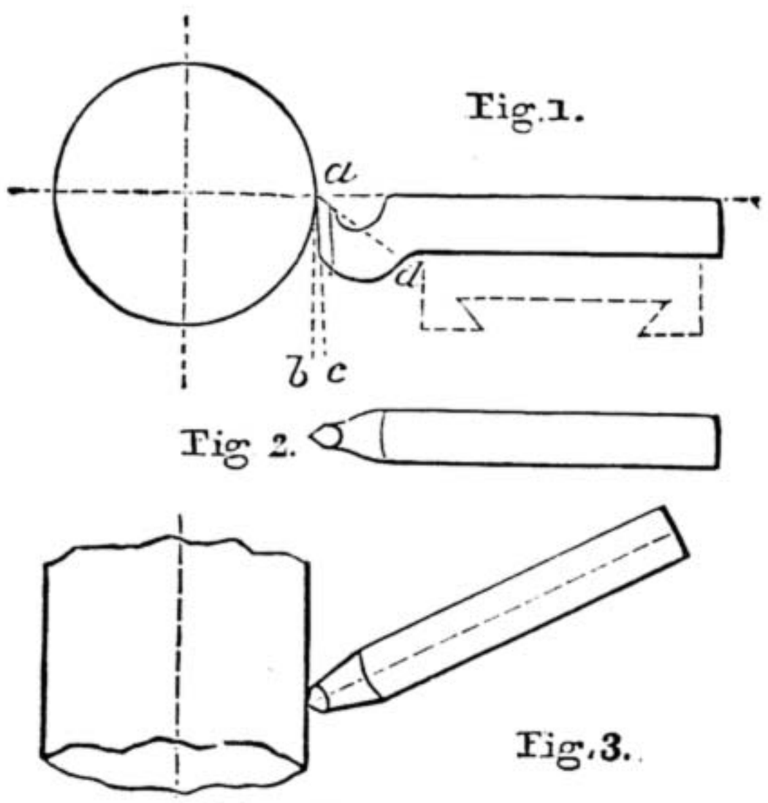
Making Slide-Rest Tools.—BLACKSMITH (*St. Keyne*).—You ask how to make tools for iron-turning. Now it would be impossible to help you effectually without giving a number of full-size drawings of the various tools employed, and this can hardly be done in the "Shop" column. Even then a drawing of a tool point is not easy to make so plain that it shall not be misunderstood. No doubt the matter will be fully treated in WORK before long, and till that is done I advise you to get a book on the subject. Hasluck's "Metal Turner's Handbook" (Crosby Lockwood & Co.) costs only 1s. "The Complete Practical Machinist," by J. Rose (Sampson Low & Co.), 12s. 6d., is a very useful but rather expensive book. I will try to give you an idea of the principles involved in tool-making. Fig. 1 shows a bar of iron with a tool cutting at the point *a*; *a b* is a vertical line drawn straight down from *a*; *a c* is a line making an angle of 5 degrees with *a b*, and that is a suitable angle for the front of the tool, the most important angle to have correct. Fortunately it is very easy to ensure this by cutting a block to lie across the trough of the grindstone in such a way that if the shank of the tool be laid upon it while the front is ground, the front angle of any tool so held will come off ground with the proper "clearance" angle of 5 degrees. The angle, *c a d*, is the cutting angle, which for iron is 60 degrees. You can make a gauge to measure this angle by filing a notch in a bit of sheet iron with a smooth cut three-square file. Now for the shape of the point as looked at from above; that is shown at Fig. 2, where the point appears a little less than a right angle, so that the tool can be used to get into a square corner. For turning a straight shaft you would have another tool with a blunt-angled point of about 120 degrees, and in this case



Making Slide-Rest Tools.

the shank of the tool would lie across the tool-plate of the slide-rest as at Fig. 3, so that one of the front edges of the front angle will lie almost parallel with the bar being turned. The cutting point, *a*, should be at the height of the centres, and water is used to lubricate while cutting; a little soap is melted into the water, and it may drip on the work or be applied with a brush.—F. A. M.

Iron Brass Lacquer.—W. H. (*Oldham*).—Your question is rather vague. It would have been better if you had given some hint as to the class of iron articles you require to give the appearance of brass. If the iron is highly polished, and treated with two or three coats of highly-coloured lacquer, it will have a yellow but not a brass colour. Such a lacquer may be made as follows:—1 pint spirits of wine, 1½ oz. shellac, ¼ oz. gum elemi, 1 oz. gum sandarach, digest in warm place for two or three days, with constant shakings. Strain and colour to required shade with dragon's blood. Slightly heat the iron, and apply with soft brush, or, perhaps, bronzing may suit your purpose. If so, I give you an outline of the process; for although you may understand all about it, it may be useful to some other reader who does not. To 1 quart methylated spirits, add 8 oz. shellac, 1 oz. gum benzoin, digest and shake, as in last receipt, and let stand for some days. Then carefully pour off the clear liquid. Have your iron articles perfectly clean and smooth. Mix very fine bronze green with sufficient quantity of the clear lacquer to ensure an opaque varnish. The shade or colour may be modified to taste by the addition of red or yellow ochre, or darkened with lamp-black. Heat the iron articles to be bronzed slightly, and apply the varnish with a soft brush, giving as many coats as desirable. When dry, touch up the more prominent parts with some of the original lacquer, and when almost dry or tacky, apply some dry gold bronze powder with a soft brush. When thoroughly dry give a coat of any good varnish. Another recipe which may suit your requirements is shellac dissolved in methylated spirits until of rather thick consistency. Mix with this as much gold bronze powder as it will take up, and at the same time be capable of flowing from a soft brush. The iron articles should be bright and clean, and when slightly heated should have an even and rather thick coat of the gold varnish. When quite dry rub down with a wet rag dipped in finest ground pumice stone; dry and polish with a soft cloth, and finally coat with clear, mastic varnish.—OPIFEX.

Design for Chuck.—ONLY AN AMATEUR.—The oval chuck consists of two parts: the chuck with a movable slide on the face, and a boss bored and tapped to fit the nose of mandrel, and the guide ring, which is fixed by two screws against the fast headstock. Figs. 1 and 2 show the face and section of chuck. The boss is bored and tapped to fit on the nose of mandrel, and the face turned up while in position; two V-edged strips are fixed on the face by screws. These must be made perfectly straight and parallel, and fixed as shown in Fig. 2; the face of the chuck has two slots formed in it. Fig. 3 is the slide, which is faced on both sides, and the edges fitted to work in the slides; at the back two steel pins are fixed, the distance between which must be the same as the outside diameter of the ring (Fig. 5). When turned true, a taper screw is generally fixed in the centre for holding the work. The face of

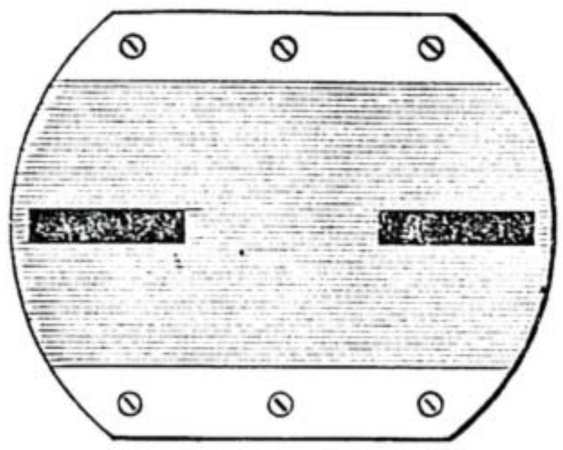


Fig. 1.

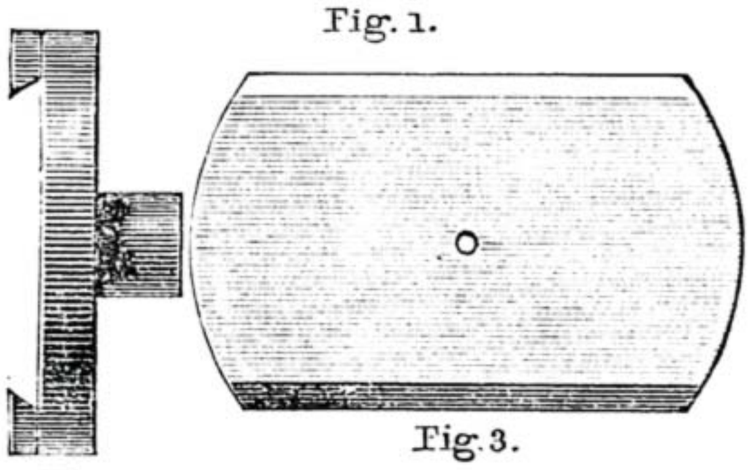


Fig. 3.

Fig. 2.

Fig. 4.

Fig. 5.

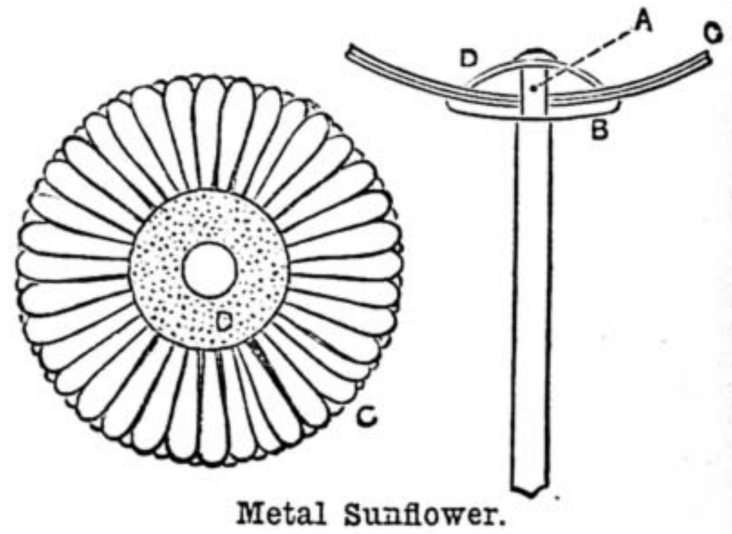
Fig. 6.

Fig. 1.—Front of Chuck. Fig. 2.—Section of Chuck. Fig. 3.—Face of Slide. Fig. 4.—Section of Slide and Pins. Fig. 5.—Guide Ring. Fig. 6.—Section of Guide Ring fixed on Headstock.

guide ring is shown in Fig. 5, and its section in Fig. 6, fixed to end of fast headstock, A. The back must be made level, and the face and edge of ring turned true. The outer ends of plate on which the ring is formed have two projections, through which screws are put to fix it to the headstock; the ends of the screws are tapered, and fit in holes at each side; these holes must be in line with centre of mandrel. The chuck is screwed on the nose of mandrel, which projects through the ring, the two pins in the slide fitting against the outer edge of ring. It will be evident that when the ring is fixed central with the mandrel, that the slide will revolve as an ordinary chuck; but when the ring is moved to either side by tightening one screw and slacking the other, the slide will at two opposite points in its revolution be that distance farther out than two other points in its revolution at right angles to them, gradually moving from the smaller to the wider points, and *vice versâ*; and if a pencil were held with its point against the slide, an oval would be described, the difference between the two diameters of which will be equal to the distance the ring has been moved from being central with the mandrel. If you construct it in metal, a few holes should be drilled in the slide, so that a wooden face can be screwed to it, on which to fix your work. Or you might make the chuck and slide of mahogany, and face the V-joints with brass plates to prevent wear, and make the boss of brass, with a flange, say, 1 in. wide and ¼ in. thick, let into a recess at the back, and fixed with screws. The ring would be a casting either iron or brass.—E.

Electric Time Alarum.—H. E. C. (*Woodford*). Fasten a pair of light springs, made of clock spring or of spring brass, to a wooden stem near the clock, as shown in my addition to your sketch. The insides of those springs, where they come in contact with each other, should be protected by pieces of platinum foil soldered on to the metal. Connect the wire from the battery to one spring, and the wire from the electric bell to the other spring. At night, when you fix the alarum on the clock, and have wound it, tie a bit of narrow silk ribbon to the alarum winder, and place the free end of it between the two springs. When the ribbon is thus placed between the springs they will be insulated from each other, and the electric bell will not ring. Pull the ribbon out, and the bell will start ringing. When the clock alarum goes off in the morning its winder will wind the ribbon around the stem, and pull it out from between the springs, and thus set the electric bell ringing. In this way the clock need not be altered at all, as the piece of wood may be fixed to a box on the mantelpiece, and placed near the clock. The springs need not be strong; in fact, should not be strong enough to hold the ribbon very tight. A bit of silk twist will do instead of ribbon, providing it keeps the springs apart.—G. E. B.

Metal Sunflower.—J. S. (*Clapham*).—You would not attempt to treat your sunflower in any but a conventional fashion, as a literal reproduction would involve very much work. A suitable method of construction is shown in the figures. Take a piece of ⅜ in. or ¾ in. copper rod, and draw down one end, A, leaving a shoulder. Get sheet copper, and cut as many circular discs as you require—one for the calyx, and say two or three for the rays, and one for the disc of the flower. Punch or drill a hole through the centre of each to pass over the



Metal Sunflower.

pin, A, which is drawn down at the top of the stem. Form a number of suitable deep serrations around the edges of the calyx, B, and of the rays, C; the latter will represent the separate florets. On the central disc, D, you should do a little repoussé work with a sharp punch, the indentations representing the florets of the disc, and on the florets of the rays punch radial grooves with a blunt chest to represent the divisions of the flowers. Then thread these separate parts over the central pin in order, the calyx first, the rays next, and the central disc last of all. Rivet the pin gently over, or tap a button-headed screw into the top of the pin to keep the parts in place. For the bud you will form one cleft disc only, riveting it first to its stem, and then closing the florets over to meet at their lips. The flower half blown should be made similarly to the one full blown, and then be partly closed over. The stems of the budding flowers will be flattened out at their lower ends, and hammered to partly embrace the main stem, to which they will be either riveted or preferably brazed. Bend all the stems to bring the faces of the flowers into the vertical direction.—J.

Small Air-Pump.—J. S. L. (*Belfast*).—You give no particulars of the purpose for which you require the air-pump. If it is for light work, as for instance microscopic preparations, you may make it in syringe form with light indiarubber valves; but if you will write particulars I will give you a dimensioned sketch from which you can make it.—F. C.

Work on Inlaying.—R. N. (*Grays*).—Messrs. Bemrose publish a book on inlaying, but it has not been of much practical use to me. Neither the "Subject Index of Modern Books" at the British Museum, nor the latest "Bookseller's Reference Catalogue," gives titles of any other. A specialist tells me that, save an old one of some thirty years ago, now rarely met with, there is no other than the above, entitled "Buhl and Marquetry."—E. B. S.

Slide Rule.—SLIDE RULE (*Manchester*).—The slide rule I never found of any use. I always found I could work more rapidly on paper than by this much-praised instrument. For that reason I am unable to answer or advise this correspondent. The use, or misuse, of this thing caused an awful blunder in H——'s office about twenty-five years since, and I have never recommended its use to any one. If a man cannot calculate without a slide rule, or book of formulæ, he is not fit to calculate at all.—F. C.

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Fumigating Oak.—F. P. (*Andover*).—You are quite correct in supposing that the sapwood will not be affected by the ammonia vapour. As you want to know what to do with the sap, I should certainly say discard it. Cut it away before making up your work. This is the best hint I can give you with regard to it, but as your intention apparently is to use the sap, the only way by which you can darken it to match the fumigated oak is by staining. You will not find it altogether an easy matter to match the colours, and it is hardly a job which a novice could undertake with certainty of success. Different stains and methods are adopted for touching up the sap. I think that perhaps the best results are got with a weak gas-black polish—*i.e.*, polish darkened with a little gas-black. In work of this sort, however, no definite rule can be given, for matching up wood is an art which can only be acquired by practice and the exercise of judgment.—D. A.

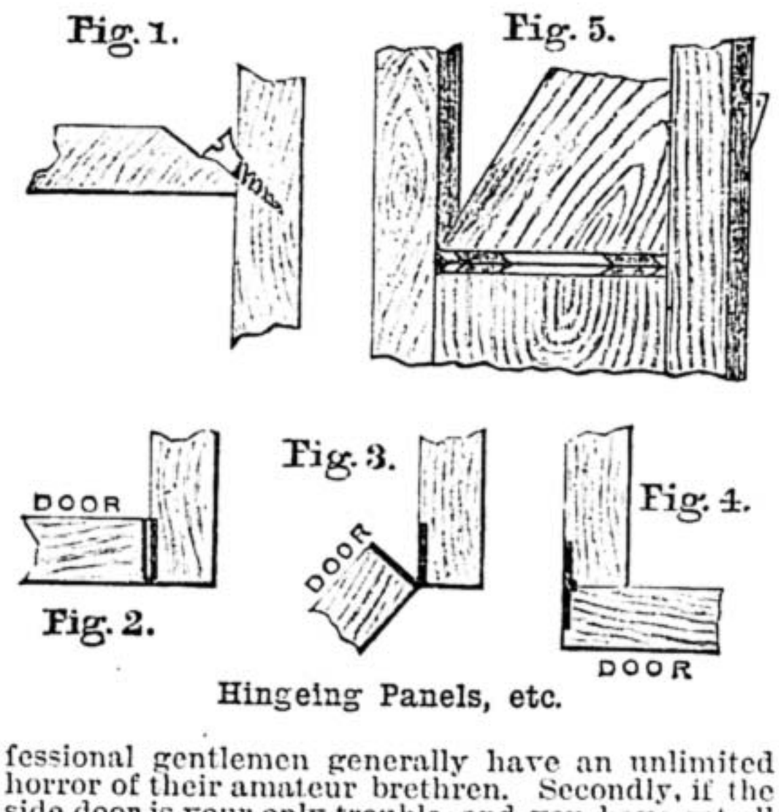
Polishing Tips.—G. D. (*Arbroath*).—I am sorry that I cannot possibly refer to your former communication to which you allude, as a letter when it is answered is done with, and I cannot pretend to remember the contents. If, as I gather, you are ROUND O, to whom an answer was given on page 508, Vol. I., which you have seen, it is surely unnecessary to tell you of a better plan of polishing oak coffins than the one you have adopted. Of course, if you want to have the colour darker you must use a stain. You will also have seen that a better filler than yours is recommended. I do not understand what you mean by using spirits of wine to "bring out all the oil." You should only use the spirit-rubber—that is, a rubber moistened with methylated spirits only—after you have bodied up your work. Whether you have done this or not I cannot understand from your letter, but you seem to be in some difficulty from marks made by the spirit. I am inclined to think that you have omitted to describe some part of your process, which, to say the least, seems a very peculiar one, and that the marks are caused by your spirit-rubber being a great deal too wet. If too much spirit is used the shellac (polish) is washed off. This you must avoid doing, otherwise you will have the trouble of going over the work again with polish.—D. A.

Staining Cycles, etc.—F. W. R. (*Harling*).—Your inquiries are within the scope of WORK, but it is quite impossible for answers to be given at once or sooner than they are. It is hardly reasonable—is it?—to ask us to take cognisance of subjects not connected with the Magazine. Your questions are answered as follows:—(1) I expect the colour of the morocco you refer to is that known as marone. It may be revived by the application of a little French polish, but unless you are very careful you will probably do more harm than good. The leather must not be saturated, but be merely wiped over with the polish. White-of-egg is sometimes used for the purpose. If the leather is much worn or abraded no treatment will avail to restore it. (2) A good mahogany stain may be made with bismark brown and vandyke brown. The former gives a very red colour, which the latter is useful to modify to any desired shade of reddish brown. Both the pigments may be dissolved with water, though a little ammonia is an advantage, especially with the brown. The stains may be kept separate or mixed together. They are more convenient in separate bottles. (3) Boiled linseed oil is used for mixing paint. I do not think raw oil is ever used in a general way. You can distinguish between the two sorts by remembering that the boiled oil is thicker than the other. (4) and (5) Parts of cycles can be obtained from most of the manufacturers, or dealers in cycle fittings and sundries. You might apply to Bown Bros., Great Eastern Street, London, E.C., who will quote prices for any parts you require. (6) To protect bright parts of machine, or any metal exposed to damp, from rusting you cannot do better than use Hartley's improved hard cold lacquer. It can be had colourless for steel, or gold colour for brass. You can get it in moderate quantities from Grew & Bridge, 42, Summer Row, Birmingham. It has a very unpleasant smell, and should therefore be applied in the open air, or in an outhouse. (7) The usual method of lining out painted work is the only practical one.—D. A.

Fire Irons.—D. W. B. S. (*Brixton*).—I hardly think that you will be able to repair your fire irons yourself, for I think it may, from your question, be inferred that you are not a metal-worker. As the threads of the screw are worn, they must be recut. It will be better for you to get this done than for you to attempt to do it yourself. If the irons are more for show than use, you might fasten the handles on sufficiently firmly with solder. A piece of lead-packing would be better than yarn or tow, but, as stated, the only permanent repair will be by recutting the threads. Gasfitting is a subject which will be treated of, but, though instructions will no doubt be of use to you in many ways, I would hardly like to promise that you will be altogether independent of plumbers. He must be a very poor professional workman who is not a long way ahead of even a more than usually skilful amateur.—D. A.

Battlesden Cart.—G. C.—The wood for building a Battlesden cart can be bought at any good timber yard, and if you have no "facilities for sawing up and planing," you might get a carpenter to do it for you; but how you propose to build a vehicle under such circumstances I do not understand. If you have room enough to carry out the work, supposing you do get the wood ready planed, etc., you surely will have sufficient space for a bench, temporary or otherwise. As I live many hundreds of miles from you, I cannot give any address in your immediate neighbourhood where timber may be purchased.—OPIFEX.

Combination Bedroom Suite.—ONE IN A FIX. (*Glasgow*).—I once heard a minister say before beginning his sermon that he was only human, and that although he was advising and correcting his flock, he was well aware that they would doubtless have to advise and correct him. I must plead the same excuse for myself, but I am afraid you have not followed my advice. If you look at my written article you will notice that I say:—"In making . . . . . get it cut out and fitted together before gluing, as it can then undergo any necessary alterations, and can be glued up afterwards. Have you done this? You say that you never had courage to attempt making anything until you saw my bedroom suite. Now that puts me in mind of a man refusing, for want of courage, to jump off a bridge into the water, but finding sufficient of it to enable him to leap off a building the same height as the bridge, on to the hard pavement below; for the majority of articles represented as in wood, which appeared before my suite, require far less trouble to attempt making. Further on you say you called upon professional gentlemen, who pronounced their verdict as "the wood is lost." Firstly, are you sure their verdict was a free one? as professional gentlemen generally have an unlimited horror of their amateur brethren. Secondly, if the side door is your only trouble, and you have got all the rest together, my opinion would be that the wood is *not* lost. I am very thankful to you for pointing out my errors, and I hope you will be partial to me, for we designers have a winding road to travel in getting up something new, working out measurements, and giving the necessary instructions, and it would indeed be surprising if we did not sometimes knock against a corner or tread upon a sharp stone. There is indeed a line or two left out of Fig. 4, which should represent the thickness of the wood. Now, presuming that you have got everything right except the long door, I will do my best to set you on the right road, although it is really surprising to me that, supposing you left the door until you had got the skeleton of the job together, as I advise, you did not measure the space where the door was to go, to see if I was correct. Of course, I know I have forgotten to mention the top and bottom board of the cupboard, and I am sorry for it, but surely you might have noticed that first as last. If you have followed my measurements, your door will be 18 in. wide and 58 in. long. All that you need do, then, is to reduce it an inch; also taking an inch off the fixed panel, leaving the movable panel the same length. You should have no difficulty in doing this, if you have joined all the other parts yourself. A top and bottom board, each 17 in. by 8½ in., can be easily screwed or nailed in after the manner shown in Fig. 1, the screws being driven from the top of the top board and bottom of the bottom board. The hingeing of door will be an easy matter; Figs. 2, 3, and 4 show it. The movable panel should be hinged as in Fig. 5. If it bites too much, round off the inside of the top edge. Let me hear again from you. In conclusion, I may say that the pages of WORK are of so much value that we refrain from giving more diagrams, etc., than are absolutely necessary; some things must be left to the reader's judgment.—J. S.



Hingeing Panels, etc.

Bagatelle Table.—H. C.—It is utterly impossible within the limits of "Shop" to give such a description of the construction as would be of any service to you. If you will say on what point you wish information, I will endeavour to help you. I should like to know whether it is a bagatelle table or a bagatelle board which you wish to make. Though you say the former, I am inclined to think you intended to ask about the latter. The sundries you inquire about can be got from any good maker. You don't give your address, so I am unable to tell you of any local manufacturer. You cannot do better than go to Hennig Bros., 29, High Street, W.C., or Edwards, Kingsland Road, E. An article on the subject will be given, but I cannot say when, so I am afraid it will not help you at present.—D. A.

Plush Cover for Box.—E. C. C.—I cannot tell you what coloured plush would go best with the copper decorations of your box, that is to say, would look best to your eyes, but my own taste would lead me to choose a dark blue. This will show the copper up well, and at the same time be in accordance with the laws of harmony in colour. You must, however, remember that in decorative articles these laws cannot be rigidly carried out, and that there is an almost endless variety of tints in plush even among those of one colour. Go to some good upholsterer, and ask him to show you his plush patterns. The best way to stick the plush to the box is by means of glue. Put this on the wood thinly and evenly, and do not press the plush too hard on it. Smooth it down gently and firmly. Of course if the glue penetrates through the plush, the effect will be bad, and you must be careful to avoid this.—D. A.

Rabbit Box.—B. E. (*Hull*).—I am afraid I do not quite clearly understand your inquiry, as surely any kind of box will do to carry a rabbit in. If I wanted to make one specially for the purpose, I think it would take the form of a plain box with a sliding side or door. To afford ventilation a few holes would be necessary, and a handle on top would be a convenience. On this rough idea you may extend to any extent, and if you are in a fix how to do whatever may be necessary, let us know where the difficulty lies, and we will try to remove it. I don't reply more fully, or we shall be having inquiries taking too trivial a form for the already overburdened "Shop" columns.—D. A.

Plate Rack.—HARRY (*Manchester*).—An article describing the construction of a plate shelf, which I hope you will think "nice," is in hand, and will appear in due course.—D. A.

Lathe and Scratch.—J. H. S. (*Edgware Road*).—I fancy you would be able to see a companion lathe and fret saw at Churchill's, and I think I caught sight of one at Melhuish's a few days ago. Certainly, if you were to drop a line to the latter you would get a reply saying whether you could be shown one by calling at Fetter Lane. I really cannot tell you where you can get a piece of broken band saw. If you particularly want one it can easily be had by buying a new one, and breaking it. You surely have not taken the idea from anything in the article I wrote on the "Scratch," that the cutter cannot be made from anything but a piece of band saw. I merely mentioned this because it is something easily obtainable by most workmen in wood, and to show that what is often nothing but waste might be used. If you cannot meet with a piece it is not worth while wasting time to hunt after it, but you might ask any one who uses a band saw for a bit. Any piece of thin steel will do, and you can have no difficulty surely in getting something suitable.—D. D.

Glaze.—J. M. F. (*Silverdale*).—Glaze is a preparation used by French polishers to give the final gloss to work which has been bodied in instead of giving it by spiriting off. It is, in fact, a cheap because speedy mode of finishing French polished work. Sometimes it is useful, but on the whole it cannot be recommended. No good polisher would think of using it except on cheap work, and many of the best of them discard it altogether. A glazed surface does not stand much wear, nor does it retain its brilliancy so long as properly French polished work. It is, however, easily applied, being simply put on with a brush or soft rubber. It is made of gum benzoin and methylated spirits in about equal quantities. The gum should be powdered, and after it has all dissolved, the mixture should be strained through fine muslin. The subject will be fully gone into in one of the articles on polishing. Your question is quite definite. I wish all were equally so.—D. A.

Fuller Cells for Electric Lamps.—H. B. G. (*Maida Hill, N.*).—Assuming that each Fuller cell has an E.M.F. of 2 volts per cell, as claimed on page 429 of "Electricity in the Service of Man," and that its internal resistance is 1 ohm per cell, then it would take 8 cells to light up a 6-volt 2½ c.p. lamp, and the light would be sustained for three hours without cleaning and recharging the battery. It is not necessary to take out either the zinc plate or the porous pot when not in use.—G. E. B.

Holes in Glass.—OLIVER (*Great Yarmouth*).—Holes may be bored in glass with an ordinary drill lubricated with turpentine and camphor. The acid you refer to is probably hydrofluoric, but I certainly should not advise you to use it.—D. A.

Bottles.—T. B. (*Rochdale*).—There is no particular form of bottle used for furniture cream. It depends a good deal on the quantity you intend buying from whom you can buy them best. You might try any local dealer or the York Bottle Company, York.—D. A.

Grinding Glass.—R. J. (*London*) asks how to grind glass, how to bevel it, where to buy a lathe specially for grinding glass, how the glass is fixed on the lathe, and what tools are required. Now this is a nice little batch of questions. But will R. J. kindly say what he intends to make, as until that is made clear I do not see how any one can give any satisfactory answer. Does R. J. propose to grind a lens, a speculum, or what? The kind of lathe and tools required depend entirely on the kind of work done.—O. B.

Address.—R. S. (*Brighton*).—Messrs. Holtzapffel's addreses are—64, Charing Cross, S.W., and 127, Long Acre, W.C.

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Blocks for Cell.—IGNIS FATUUS.—The blocks you mention are the Agglomerate blocks. These can only be practically constructed by the proper plant and machinery. They consist of a mixture of carbon dust and manganese, which are pressed into the shape you see them by means of pressure (generally hydraulic) of many tons. You can construct them somewhat roughly by the following method. Take equal parts of powdered carbon and manganese (these must be very finely powdered); mix these into a paste with a little molasses, press very tightly into a suitable mould, dry in a hot oven, and then apply pressure to the block by means of a screw press, and allow to remain under twenty-four hours; it will then be ready to use, but you must be very careful in using it, as it will be liable to crumble to pieces, on account of not sufficient pressure being applied by the press. Our querist had much better buy his blocks, as the construction of them is almost certain to be a failure, unless there is the proper plant at our querist's disposal; but at any rate the above process is the principle of the construction of them.—F. W. M.

Emery Wheel.—J. S. (*Leicester*).—Your most economical course will be to send the centre to a maker, who will fit a new emery wheel to it. Unless you are expert in the work you will fail in an attempt to cast one on.—F. C.

Beryl.—W. J. C. (*Jersey*) says he wishes to know where and at what cost he can procure specimens of "rough beryl." This is rather a vague question, as I do not know whether the beryl is intended for gem purposes or in the "rough;" or whether it is the common and coarse kind, as cabinet specimens. Doubtless W. J. C. is aware that beryl includes various gems, and, like quartz for example, is at the head of varieties. I have in my collection the common kind which is not at all suitable for gem purposes. I have been in communication with several mineralogists on the matter—hence the delay in answering. Mr. F. H. Butler, M.A., 148, Brompton Road, London, can supply specimens of beryl from 4d. upwards. As I have not seen the said specimens I cannot give information as to size, quality, etc., but having the name of the dealer, W. J. C. can get that for himself. If W. J. C. will communicate with me or send his address, I should be glad to compare notes with him on minerals; perhaps we could help each other. I have a pretty good collection, and should be glad to exchange if possible. Possibly the addresses of the following mineralogists may be of service in addition to the one given:—Mr. Cuttle, 30, Berners Street, London, W.; Mr. Gregory, 88, Charlotte Street, Fitzroy Square, W.; Mr. Henson, 277, Strand, W.C.; Mr. Wright, 204, Regent Street, W.—O. B.

Indiarubber Stamp Inks.—A. A. (*Castleford*).—A solution of aniline can only be kept from drying on the pad by the addition of some hygroscopic substance, such as glycerine or treacle. The following recipes for violet ink will probably be found useful. The second is the more expensive, but is the easier to make and much more satisfactory in use. (1) Aniline violet, 90 grains; boiling distilled water, 1 ounce; glycerine, 20 to 30 drops; treacle, sufficient to thicken. (2) Aniline violet (best quality), 2 drachms; methylated spirit, 25 drachms; glycerine, 20 drachms; treacle, 5 drachms; water, 10 drachms. The aniline is to be dissolved in the methylated spirit by vigorous shaking, after which the remaining ingredients are to be added and the whole well shaken together until thoroughly mixed. If the dye used be of good quality, and carefully dissolved, there will be little or no sediment; should there be any the ink may be filtered through a plug of cotton wool placed in a funnel.—QUI VIVE.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Silting up of Waterpipes.—ADALIA (*Asia Minor*) writes:—"The water of our town forms stone in the ponds and waterpipes—in fact everywhere it passes. Is there any way of clearing the waterpipes of my house without taking them off, as doing so would be impossible for me, as no men here could do it, and I should have to bring men from Smyrna, 400 miles off, to do it for me?"

Colouring Ceiling.—BOATHOOK writes:—"Will some kind friend (practical) help a lame dog over the stile? I have had a large ceiling to distemper pink—it had been coloured the same before. I washed it well off, and when dry gave it a thin coat of size to stop the suction as I thought, then mixed my whiting with thin jellied glue size, but when I came to go over it, I was fairly in a fix, for it sucked in as fast as I put it on, and although I went from one end of the plank to the other, by the time I had got down and shifted the steps for the next turn it all dried in, and the next joint showed dreadfully, and when dry it looked wretched. Well, then I got a mate to assist, but when we came to put on the next coat the stuff rolled up in a way that was a caution; and when dry this time it might have been labelled a true representation of a storm on the Red Sea. Now, will some kind brother tell me what I should do? Can I put anything in the whiting, or what must I do to the ceiling? The first coat, I may say, was thick, but still the dark plaster seemed to show through it." [Wash off your distemper and use Alabastine. See page 1 of this Volume.—ED.]

Motors for Lathes, etc.—MOTOR wishes to know if any reader has had experience of the capabilities of "The Demon Water Motors," advertised in page 750, Vol. I., of WORK. If no reply can be given respecting this particular water motor, suggestions as to the use and cost of any other efficient water motor will be thankfully received.

Boat Building.—BOATHOOK (*Manchester*) writes:—"Will some kind friend help me out of the following fix? I have built a rowing boat of the following dimensions, viz.—12 ft. over all, 3 ft. wide amidships, and about 16 in. deep; it has a wooden keel 3 in. by 1¼ in., and has outriggers that extend 16 in. over side. Now, when it is put well into the water on canal it floats perfectly level, and only about 5 in. in the water, in fact it rides as light as a cork on the water. But alas! when two or three get in, it sinks down in the water considerably; but the least movement out of the centre, and it is in danger of rocking over at once. I could not build it any wider or longer on account of want of room; have I made it too shallow, or what? Any real practical advice will be thankfully received. My own idea was to put on an extra wooden keel, or would lead do better? or to place outside at the water level two boards about 6 in. wide, and cover the under side with cork—a sort of wings, to prevent rocking over—but it certainly would look ugly."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Exhaust Fan.—T. D. G. writes in reply to D. B. S. (*Ferns*) (see page 750, Vol. I.):—"The most suitable apparatus for D. B. S. (*Ferns*) is a good air-propeller. I can let him know something about one that is used in carpet-beating machines, chaff-cutting rooms, and other places where there is a lot of dust to contend with."

Exhaust Fan or Ventilator.—In reply to D. B. S. (*Ferns*) (see page 750, Vol. I.), G. & Co. (*Glasgow*) write to say they have an exhaust ventilator which is effectual in drawing off light dust, hot and foul air, etc., in mills, warehouses, schools, workshops, etc.

To Make Boots Watertight.—WORKER BEE writes in reply to RUTHENPHARL (*Saltburn-by-the-Sea*) (see page 750, Vol. I.):—"Melt together 6½ parts beeswax (get it genuine, from a beekeeper), 26½ parts of mutton fat, 6½ parts thick turpentine, 6½ parts olive oil, 13 parts lard; well heat 5 parts of lamp-black and stir it into the melted mass. The mass is then poured into little wooden boxes and allowed to cool. Apply with the fingers before a warm fire. It will soften hard boots as well as make them perfectly watertight—provided, of course, they are sound."

Exhaust Fan and Ventilator.—W. M. D. (*Kelso*) writes in reply to D. B. S. (*Ferns*) (see page 750, Vol. I.):—"I have had considerable experience with exhaust fans, as used in flour milling processes, and I think the system which is best for keeping a flour mill practically free from dust will probably be suitable for D. B. S. I would advise him to fix, say a 30 in. fan, driven about 700 or 800, on the floor of his loft, with the mouth of it directed upwards through roof, taking care to have no sharp bends in it; he should then have an air trunk, about 10 in. square, fixed below the floor of his loft, extending the whole length of shop, or as far as to reach his machines; then this trunk should be connected to his fan by two spouts, one to each side of fan; he may then connect each machine to main air trunk by smaller ones, about 4 in. square. This will only work well if he can partially enclose his machines so as to have not more than a quarter of their circumference open for grinder to work at."

Fret Machine.—A. A. (*Coventry*) writes:—"If FAIR PLAY (see page 763, Vol. I.) will refer to my saw, he will see it is fixed on my lathe bed, and works by the same crank and fly wheel. I should like to see the saw he has made, that works so well, from the design by W. R. S., for, in spite of explanations, I am still doubtful."

Photo Zinc Etching.—S. C. R. (*Derby*) writes in answer to O. G. B. I. (see page 763, Vol. I.):—"I would ask him what class of negatives he is using; the negatives which are used for this class of work must either be in line, dots, or stipple. The whole of the designs must show as clear glass, whilst the other parts must be nearly opaque. Now, as regards the film of bitumen, it must be as thin as ever you can get it, and show on the zinc merely as a thin golden stain. I should recommend O. G. B. I. to first master the albumen process, and then take up the one in bitumen."

Exhaust Fan.—THE BLACKMAN VENTILATING COMPANY, LIM., write in reply to D. B. S.'s (*Ferns*) query as to exhaust fan or ventilator (see page 750, Vol. I.):—"If he will write us, we shall be pleased to give him, free of charge, the benefit of our experience in dealing with scores of similar places."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—E. M. A. (*Salisbury*); F. T. (*Hants*); C. H. T.; B. B. (*London, E.*); E. H. (*Stockport*); E. C. M. (*Ipswich*); W. D. (*Newcastle-on-Tyne*); W. W. (*Whitehaven*); G. E. S.; I. S. (*Dorchester*); W. C. T. (*Glasgow*); J. M. (*Bournemouth*); G. T. (*Oswestry*); MUS. CO.; INQUIRER; C. W. J. (*Clapham Common*); W. L. C. (*Aberdeen*); G. P. (*Sussex*); C. H. G. (*Loughborough*); CLAUDE; ANXIOUS TO KNOW; H. B. (*Birmingham*); DISAPPOINTED; R. J. E. M. (*Athlone*); PAINTER; APPRENTICE; T. P. H. (*Liverpool*); ANXIOUS; A MONTHLY READER OF "WORK"; A. W. H. (*Halifax*); J. W. B. (*Oldham*); A. G. P. (*Hastings*); A. G. R. (*Gravesend*); PHI; FRITZ COMBE; G. R. (*Sunderland*); E. S. (*Manchester*); E. H. M. (*Thackley*); BEESWAX; WATCHMAKER; H. G. N. (*Islington*); W. C. (*Hornsey, N.*); DYNAMO; E. F. (*Battersea*); LEDGER; FAIRY BELLS; A. B. C. D. (*Tooting*); W. C. (*Newcastle-on-Tyne*); R. P. (*Carnarvon*); BOTCH; LEO; H. S. (*Birmingham*); F. C. B. (*Battle*); P. J. A. (*Chorley*); D. A. C. (*Aberdeen*); J. K. (*Oldham*); W. S. (*Holloway*); A. W. A. (*Belston*); H. H. (*Southgate*); A WOOD CARVER.

Trade Notes and Memoranda.

ANOTHER bridge is in contemplation across the Niagara. It is to be near the International Bridge, and it is to be for the exclusive use of the Canadian Pacific Railway Company. The new bridge is, of course, this company's scheme, and the reason for it is the substantial one, as given out by Mr. Van Horne, the chairman, that the Canadian Pacific Company finds it inconvenient to have to depend upon a right of way not absolutely under its own control.

THE following method of polishing wood with charcoal is much used by French cabinet-makers. It is only applicable to things made of carefully-selected woods, of a close and compact grain. They are first covered with a coat of camphor, dissolved in water, and almost immediately afterwards with another coat, composed chiefly of sulphate of iron and nutgall. The two compositions, in blending, penetrate the wood and give it an indelible tinge, and render it impervious to the attacks of insects. When these two coats are dry, they rub the surface of the wood at first with a very hard brush of couch grass (*Chien dent.*) and then with charcoal of substances as light and friable as possible, because if a single hard grain remained in the charcoal, this alone would scratch the surface, which they wish to render perfectly smooth. The flat parts are rubbed with natural stick charcoal, and the indented portions and crevices with charcoal powder. Alternately with the charcoal, the workman also rubs his piece of furniture with flannel soaked in linseed oil and the essence of turpentine. These pouncings repeated several times cause the charcoal powder and the oil to penetrate the wood, giving the article of furniture a beautiful colour and a perfect polish which has none of the flaws of ordinary varnish.

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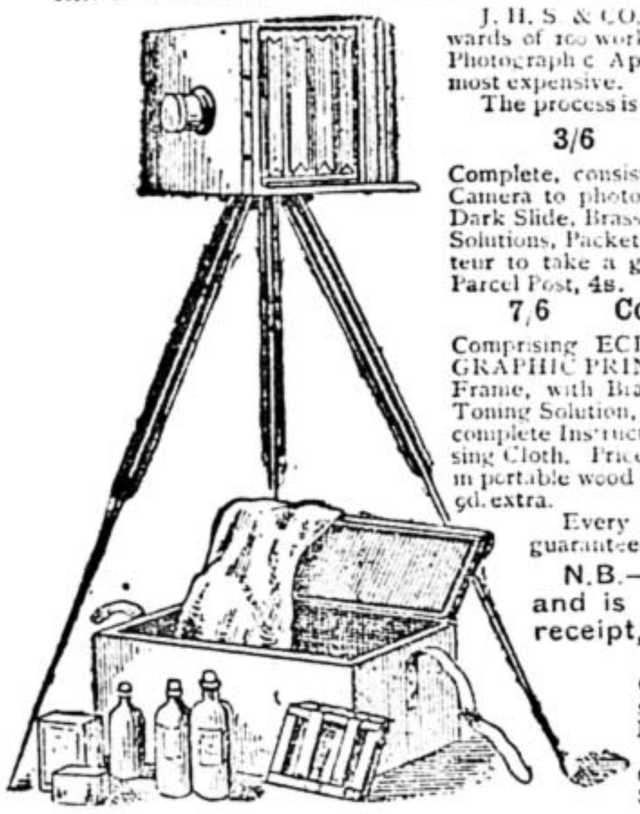

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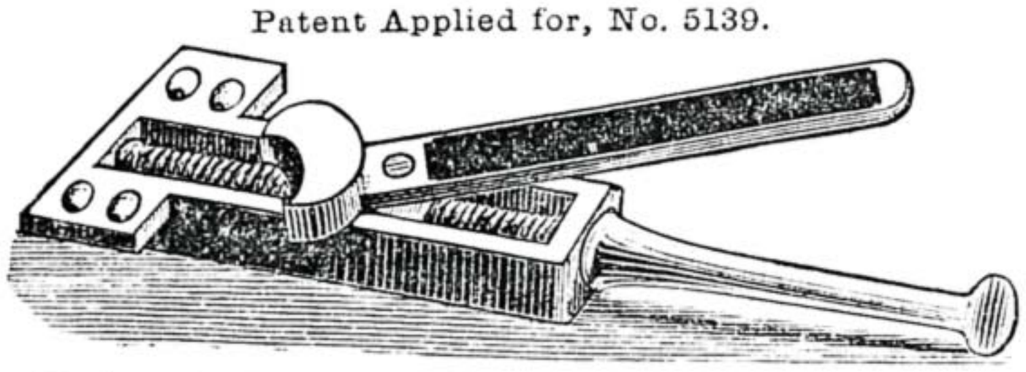

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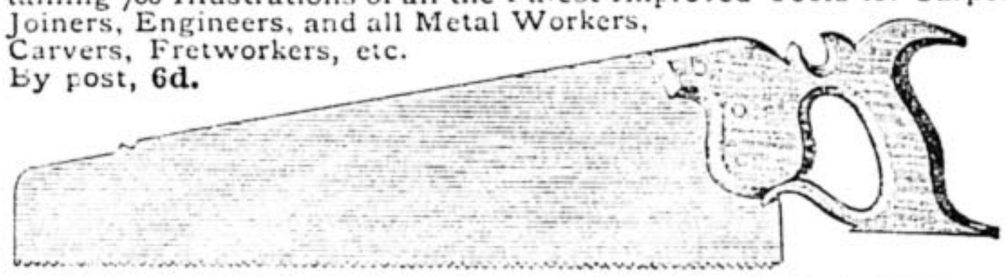

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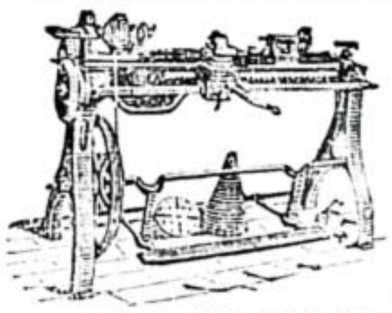

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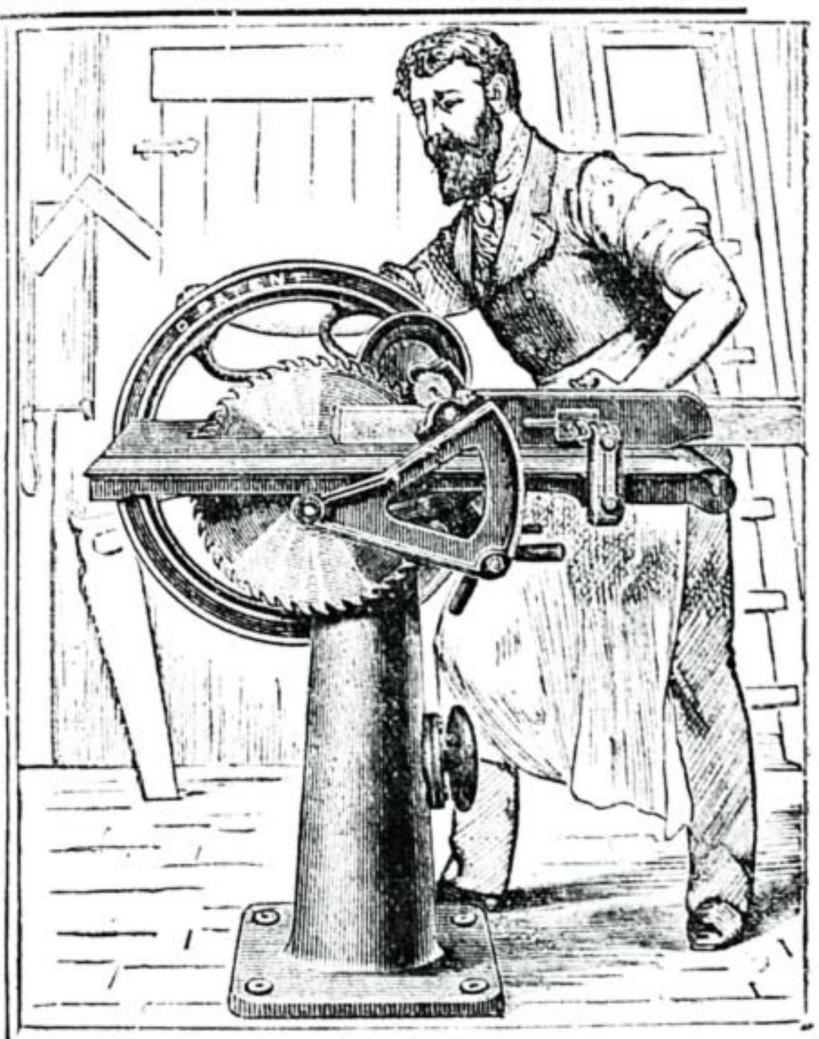

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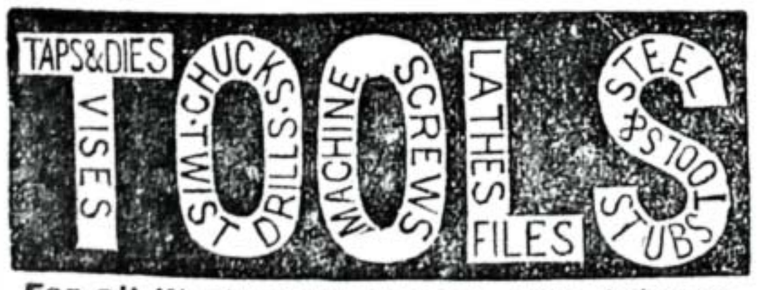

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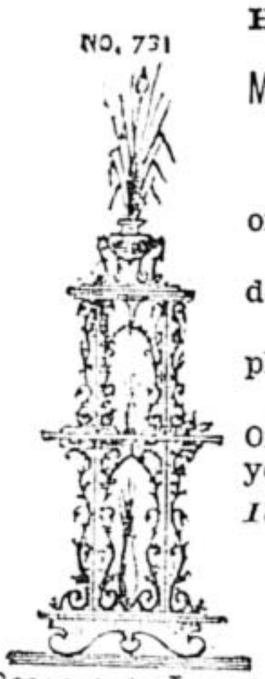

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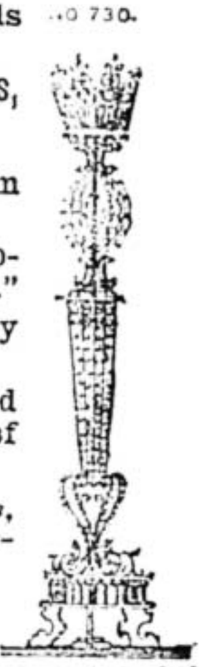

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